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Certificado de la funcionalidad LVRT y HVTR

PARQUE FOTOVOLTAICO CARACOLI

CanadianSolar Engineering & Construction	K. Fan				G. Rivera						M. Yu		
	COLLABORATORS				VERIFIED BY						VALIDATED BY		
	GROUP	TYPE	COUNTRY		PROJECT CODE				PROGRESSIVE			REVISION	
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CLASSIFICATION: FOR VALIDATION					UTILIZATION SCOPE: FOR CONSTRUCTION								

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TEST REPORT
IEC TS 62910
Utility-interconnected photovoltaic inverters - Test procedure for low voltage ride-through measurements

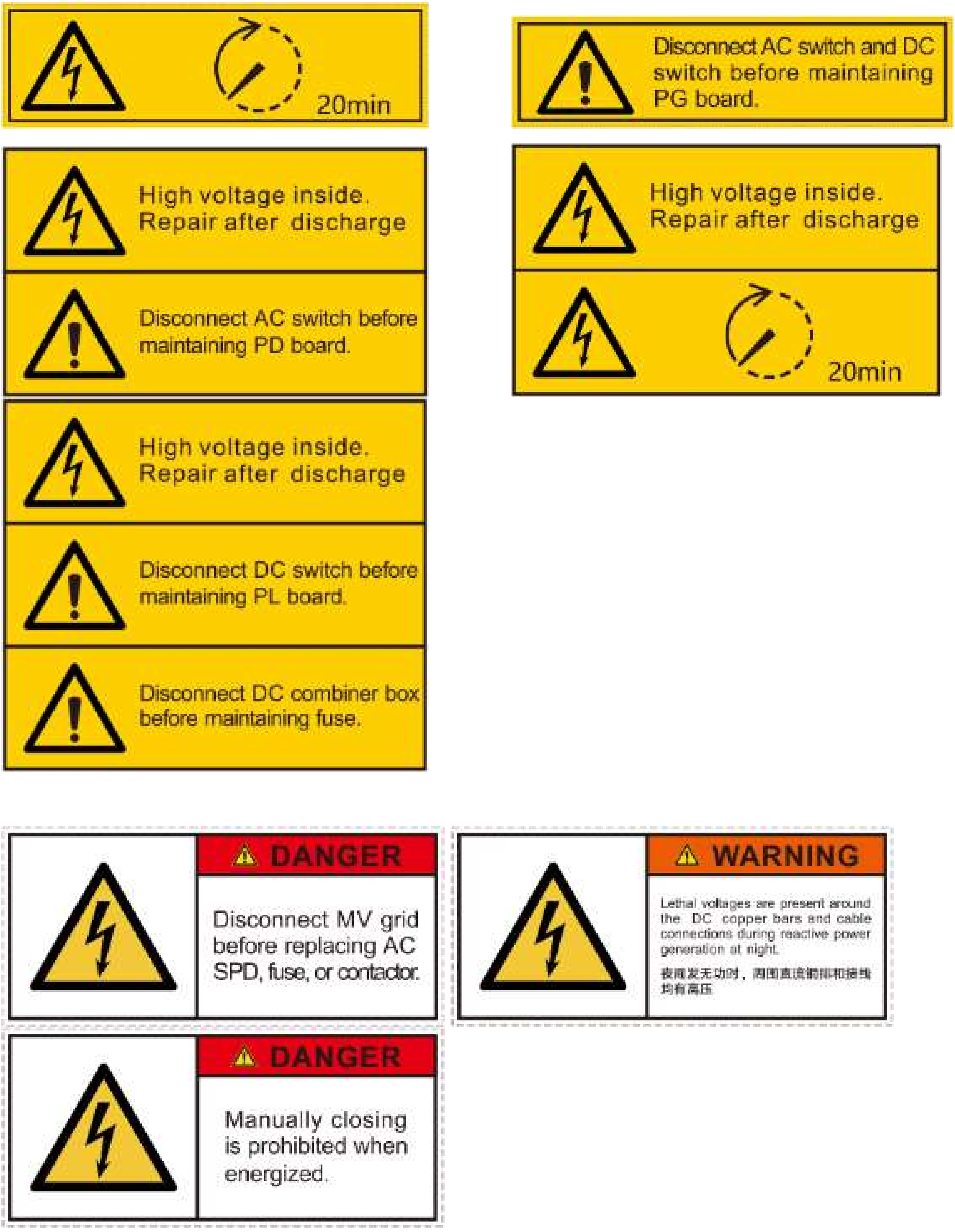
Report	
Report Number.................................:	6092407.51
Date of issue ....:	2020-12-23
Total number of pages	81
Testing Laboratory.........................:	DEKRA Testing and Certification (Suzhou) Co., Ltd.
Address ....:	No.99, Hongye Road, Suzhou Industrial Park, Suzhou, Jiangsu, P.R. China
Applicant's name............................:	Sungrow Power Supply Co., Ltd.
Address ....:	No.1699 Xiyou Rd., New & High Technology Industrial Development Zone, 230088, Hefei, P. R. China
Test specification:	
Standard ....:	IEC TS 62910:2020
Test procedure ....:	Type test
Non-standard test method................:	N/A
Test Report Form No......................:	IEC TS 62910_V2.0
Test Report Form(s) Originator ....:	DEKRA Testing and Certification (Suzhou) Co., Ltd.
Master TRF ....:	Dated 2020-08
Test item description ....:	Grid-connected PV inverter
Trade Mark ....:	阳光电源 SUNGROW
Manufacturer ....:	Sungrow Power Supply Co., Ltd. No.1699 Xiyou Rd., New & High Technology Industrial Development Zone, 230088, Hefei, P. R. China
Model/Type reference ....:	SG3125HV-30, SG3125HV-31, SG3125HV-32

Ratings...:	Operating temperature range: - 35°C to + 60°C Protective class: I Ingress protection rating: IP65 (Optional IP55) Power factor range (adjustable): 0.8 leading…0.8 lagging SG3125HV-30: PV input: Max. 1500 Vdc, MPPT voltage range: 875-1300 Vdc, max current: 3997 A, Isc PV: 10000 A Output: 600V, 3~, 50/60 Hz, max 3308 A, rated 3125 kW, max 3437 kVA SG3125HV-31: PV input: Max. 1500 Vdc, MPPT voltage range: 915-1300 Vdc, max current: 3997 A, Isc PV: 10000 A Output: 630V, 3~, 50/60 Hz, max 3308 A, rated 3125 kW, max 3610 kVA SG3125HV-32: PV input: Max. 1500 Vdc, MPPT voltage range: 960-1300 Vdc, max current: 3997 A, Isc PV: 10000 A Output: 660V, 3~, 50/60 Hz, max 3308 A, rated 3125 kW, max 3781 kVA

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	Testing Laboratory:	DEKRA Testing and Certification (Suzhou) Co., Ltd.	
Testing location/ address...............................:		No.99, Hongye Road, Suzhou Industrial Park, Suzhou, Jiangsu, P.R. China	
☒	Associated Testing Laboratory:	Shanghai Testing & Ispection Institute for Electrical Equipment Co.,Ltd	
Testing location/ address...............................:		No.505, Wuning Road, Putuo District,Shanghai, China	
Tested by (name, function, signature)............:		Albert Liang	Albert Liang
Approved by (name, function, signature) ....:		Jason Guo	JasonGuo
☐	~~Testing procedure: CTF Stage 1:~~		
~~Testing location/ address...............................:~~			
~~Tested by (name, function, signature)............:~~			
~~Approved by (name, function, signature) ....:~~			
☐	~~Testing procedure: CTF Stage 2:~~		
~~Testing location/ address...............................:~~			
~~Tested by (name + signature) ....:~~			
~~Witnessed by (name, function, signature)......:~~			
~~Approved by (name, function, signature) ....:~~			
☐	~~Testing procedure: CTF Stage 3:~~		
☐	~~Testing procedure: CTF Stage 4:~~		
~~Testing location/ address...............................:~~			
~~Tested by (name, function, signature)............:~~			
~~Witnessed by (name, function, signature)......:~~			
~~Approved by (name, function, signature) ....:~~			
~~Supervised by (name, function, signature).....:~~			

Rating label:

Warning Label:



Test item particulars:	
Equipment mobility ....:	movable hand-held stationary fixed transportable for building-in
Connection to the mains ....:	pluggable equipment direct plug-in permanent connection for building-in
Enviromental category ....:	outdoor indoor unconditional indoor conditional
Over voltage category Mains ....:	OVC I OVC II OVC III OVC IV
Over voltage category PV ....:	OVC I OVC II OVC III OVC IV
Mains supply tolerance (%)..:	±10%
Tested for power systems ....:	TN
IT testing, phase-phase voltage (V)..............................:	N/A
Class of equipment..:	Class I Class II Class III Not classified
Mass of equipment (kg)..:	3200
Pollution degree..:	Outside PD3; Inside PD2
IP protection class ....:	IP65 (Optional IP55)
Possible test case verdicts:	
- test case does not apply to the test object ....:	N/A
- test object does meet the requirement.......................:	P (Pass)
- test object does not meet the requirement.................:	F (Fail)
- this clause is information reference for installation ....:	Info.
Testing:	
Date of receipt of test item ....:	2020-10-25 (samples provided by applicant)
Date (s) of performance of tests ....:	2020-10-25 to 2020-11-30

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to account the uncertainty associated with the measurement result.
This report is only for reference and is not used for legal proof function in China market.
The information provided by the customer in this report may affect the validity of the results, the test lab is not responsible for it.

"(See Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

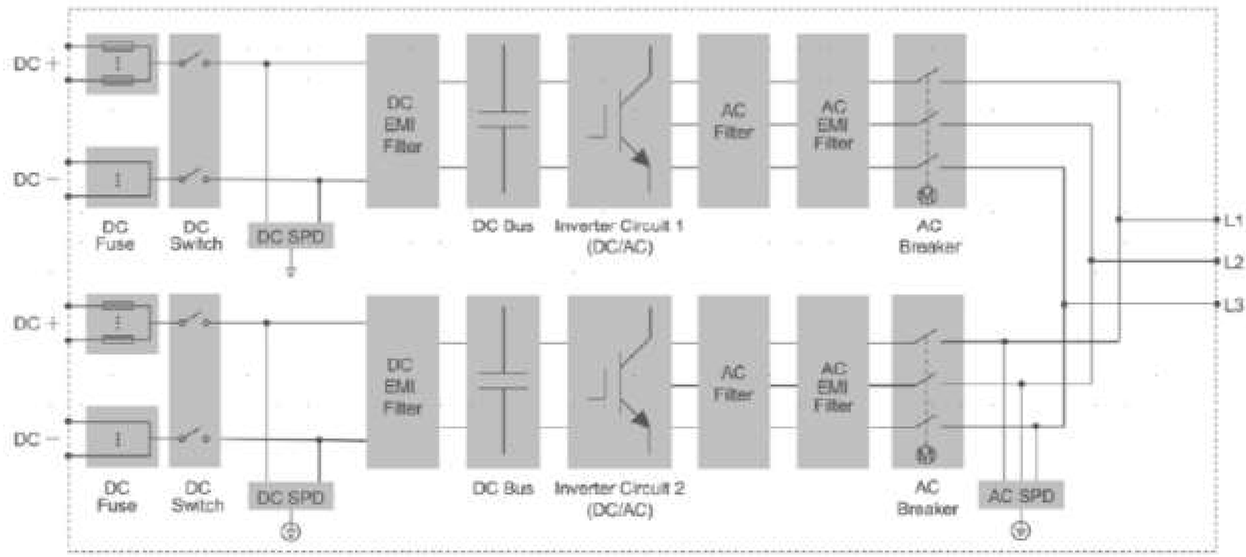
Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

Name and address of factory (ies)
1. Sungrow Power Supply Co., Ltd. No.1699 Xiyou Rd., New & High Technology Industrial Development Zone, Hefei 230088 P.R. China 2. Sungrow Power Supply Co., Ltd. No. 608 Changning Avenue, New & High Technology Industrial Development Zone, Hefei 230088 P.R. China 3. Sungrow Developers (India) Private Limited No. 85, Kaniminike village, Kengeri hobli Bangalore South Taluk, 560074 Bangalore, India

General product information:

Brief description:
The PCE under test (EUT) is Grid-Connected PV Inverter which utilizes the advanced power electronics conversion components such as MosFET, IGBT, IPM to convert the variable DC power generated from the photovoltaic (PV) arrays to the stable utility AC power which can be fed into the commercial electrical grid.
The PCE under test is three-phase Grid-Connected PV Inverter for solar power generation with the rated output power of 3125 kW. The external circuit breakers or fuses for PV array and Grid connection are required which the statements are provided in the installation manual.

Block Diagram:



The models SG3125HV-31, SG3125HV-30 are identical to SG3125HV-32 except for the model name and electrical ratings.
Unless otherwise specified, all the tests were conducted on the basic model of SG3125HV-32 to represent the others.

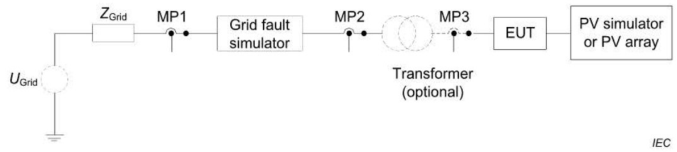
The product was tested on:

Firmware version:

DSP_SG3125HV-30_V1_A

LCD_SG3125HV-30_V1_A

Unless otherwise specified, all tests were conducted on basic model of SG3125HV-32 to represent the other models.

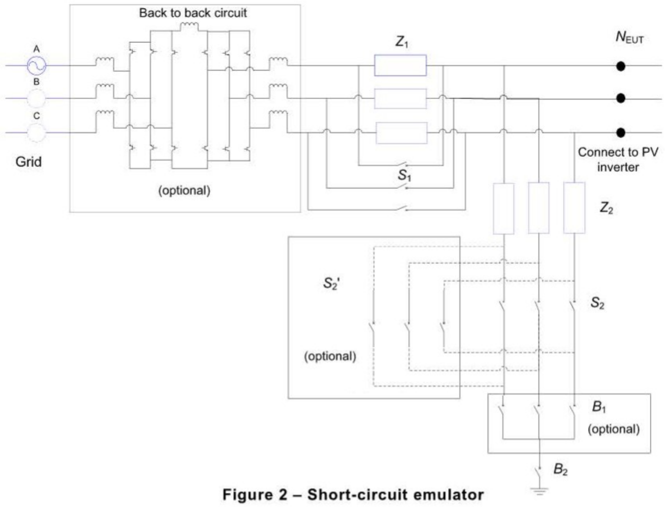
IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
4	Test circuit and equipment		P
4.1	General		P
	The circuits and equipment described in this clause are developed to allow tests that simulate the full range of anticipated grid faults, including:		P
	• Single phase to ground fault (any phase)		P
	• Two phase isolated fault, between any two phases		P
	• Two phase grounded fault, involving any two phases		P
	• Three phase short-circuit fault.		P
	A full discussion of these faults and the resulting impact on voltage magnitude and phase angles is included in Annex A.		P
	The short circuit emulator and grid simulator described in 4.3.3 and 4.3.4 are informative examples and are not intended to restrict design flexibility. Other designs may be used to achieve equivalent test functionality.	The grid simulator used to achieve test of 4.3.4.	P
4.2	Test circuit		P
	The LVRT test circuit includes a DC source, the EUT, a grid fault simulator and the grid. A PV simulator (or PV array) provides input energy for the EUT. The output of the EUT is connected to the grid via a grid fault simulator, as shown in Figure 1.  NOTE MP1 is the measurement point between the grid and the grid fault simulator; MP2 is the measurement point at the high voltage side of the transformer; MP3 is the measurement point at the low voltage side of the transformer. **Figure 1 – Testing circuit diagram**	PV array simulator and the grid simulator used in the LVRT test circuit.	P
4.3	Test equipment		P
4.3.1	Measuring instruments		P
	Waveforms shall be measured by a device with memory function, for example, a storage or digital oscilloscope, or a high speed data acquisition device. Accuracy of the oscilloscope or data acquisition system should be at least 0.2% of full scale. The analogue to A/D of the measurement device shall have at least 12 bit resolution (in order to maintain the required measurement accuracy).		P

IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
	Voltage transducers (or voltage transformers) and current transducers (or current transformers) are the required sensors for measurement. The accuracy of the transducers should be 0.5 % of full scale or better. It is necessary to select the transducer measuring range depending on the normal value of the signal to be measured. The selected measuring range shall not exceed 150 % of the normal value of the measured signal. The transducer accuracy requirements are shown in Table 1		P

Table 1 – Accuracy of measurements

Measurement device	Accuracy
Data acquisition device	0,2 % full scale
Voltage transducer	0,5 % full scale
Current transducer	0,5 % full scale

4.3.2	DC source		P
	A PV array, PV array simulator or controlled DC source with PV characteristics may be used as the DC power source to supply input energy for the LVRT test. As the EUT input source, the DC power source shall be capable of supplying the EUT maximum input power and other power levels during the test, at minimum and maximum input operating voltages of the EUT.	PV array simulator used as the DC power source to supply input energy.	P
	The PV simulator should emulate the current/voltage characteristic of the PV module or PV array for which the EUT is designed. The response time of a PV simulator should not be longer than the MPP tracking response time of EUT.		P
	For a EUT under test without galvanic isolation between the DC side and AC side, the output of the PV simulator shall not be earthed.		P
	The equivalent capacitance between the output of the PV simulator and earth should be as low as possible in order to minimize the impact on the EUT.		P
	A PV array used as the EUT input source shall be capable of matching the EUT input power levels specified by the test conditions. It is necessary to select a period of time in which the solar irradiance is stable and does not vary by more than 5 % during the test.		P
4.3.3	Short-circuit emulator	The grid simulator used to achieve LVRT function.	N/A

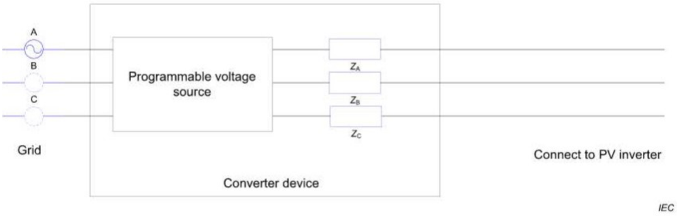
IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
	As part of the grid simulator device, the short-circuit emulator is used to create the voltage drops due to short-circuits between the two or three phases, or between one or two phases to ground, via the impedance network Z_1 and Z_2 as shown in the test device layout in Figure 2.  **Figure 2 – Short-circuit emulator**		N/A
	The impedance Z_1 is used to limit the effect of the short circuit on the utility service that powers the test circuit. The sizing of Z_1 shall therefore account for all test sequences to be performed and limit the short-circuit current taken from the grid to values that do not cause an excessive reduction of the grid voltage. Considering an acceptable voltage reduction of at most 5 % when performing the test, the minimum value of Z_1 shall be at least $20 \times Z_{Grid}$, where Z_{Grid} is the grid short-circuit impedance measured at the test circuit connection point.		N/A
	To ensure that the test is realistic, however, the apparent short-circuit power (S_{EUT}) available at the EUT connection node N_{EUT} should be at least equal to $3 \times Pn$. where Pn is the rated power of the EUT (minimum value $S_{EUT} > 3 \times Pn$. recommended S_{EUT} = 5 to $6 \times Pn$), This means that during the short-circuit tests, the contribution of current through Z_1 and Z_2 from the grid remains dominant compared to the current contributed by the EUT. In this way, the inverter current does not create a significant voltage rise for the duration of the test relative to the no-load drop.		N/A
	The two conditions described above define the minimum and maximum limits of Z_1. The two conditions combined also define the limit criteria for the choice of a grid infrastructure suitable for performing the test with the impedance circuit. If the grid infrastructure cannot meet the above requirements, an alternative test circuit utilizing a back-to-back converter is allowed, as shown in Figure 2 and may be added to reduce the grid short-circuit impedance Z_{Grid}.		N/A

IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
	Generally, the X/R value of inductor Z_1 and Z_2 for the short-circuit emulator may close to the transmission line impedance values for different countries and regions. It is also appropriate that the inductive impedances Z_1 and Z_2 should be characterised by an X/R ratio equal to at least 3, in order to reproduce the typical minimum values of X/R found in HV as well as MV power lines.		N/A
	A bypass connection (Switch S_1) of Z_1 is usually used to prevent overheating of the impedance Z_1 before and after the execution of each test sequence.		N/A
	The voltage drop is created by connecting the impedance Z_2 by the switch S_2' If the voltage drop is required to be created twice in a short period (for double drop tests), a parallel switch S_2' is normally used. The value of $Z_2/(Z_1+Z_2+Z_{Grid})$ shall be adjusted to the required voltage magnitudes. For example, when the required voltage magnitude is 50 % of the rated voltage, the value of $Z_2/(Z_1+Z_2+Z_{Grid})$ should be about 0.5.		N/A
	The switch S_2 shall be able to accurately control the time between connection and disconnection of Z_2 for single phase, two-phase or three-phase tests. If the phase of switch S_2 cannot be independently controlled, the serial switch S_1 may be used to choose the fault phase. S_2 is used to select whether the fault is to earth or not. All switches may be either mechanical circuit breakers or power electronic devices.		N/A
	The status of switch S_1 and S_2 should be set before performing the test The status of switches corresponding to fault types is shown in Table 2.		N/A
	The test report shall specify the values of impedances Z_1 and Z_2' the related X/R ratio, and a description of the circuit used. In addition, the grid short-circuit power available at the voltage level at which the test is performed shall be documented.		N/A
	The status of switches and fault types are shown in Table 2.		N/A

Table 2 – Fault type and switch status

Fault type	Switch status			
	Phase A of B_1	Phase B of B_1	Phase C of B_1	B_2
Phase A to ground	Closed	Open	Open	Closed
Phase B to ground	Open	Closed	Open	Closed
Phase C to ground	Open	Open	Closed	Closed
Phase A and B to ground	Closed	Closed	Open	Closed
Phase B and C to ground	Open	Closed	Closed	Closed
Phase C and A to ground	Closed	Open	Closed	Closed
Phase A and B	Closed	Closed	Open	Open
Phase B and C	Open	Closed	Closed	Open
Phase C and A	Closed	Open	Closed	Open
Phase A, B and C	Closed	Closed	Closed	–
During the period of voltage drop, S_1 should be opened first. S_2 should be closed after S_1 is opened. The time interval between the above two actions shall be very short. During the period of voltage recovery, S_2 should be opened first. S_1 should be closed after S_2 is opened. The time interval between the above two actions shall be very short.				

4.3.4	Converter based grid simulator		P

IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
	The test circuit mentioned in 4.3.3 is recommended for simulation of grid faults. However, if the test conditions cannot be met, an alternative test circuit utilizing a back-to-back converter is allowed, as shown in Figure 3.  **Figure 3 – Converter device example**		P
	The test circuit essentially comprises a voltage source with a low internal resistance combined with broadband amplifiers (linear or forced switching type) capable of faithfully reproducing three sinusoidal voltages with controlled harmonic content, and adjustable amplitude, fundamental frequency and phase relationship within broad margins.		P
	When the converter is used, it shall meet the following requirements:		P
	a) It shall be capable of independently controlling the three phases in terms of amplitude and phase angle. b) It shall incorporate impedances Z_A, Z_S and Z_C, that can be adjusted in order to reproduce the ohmic and inductive components of short-circuit impedances that are typical of the grid. c) It shall be capable of reproducing the phase voltages and relative phase angles that occur on the LV side of transformers in the event of each of the various fault types. (See Annex A for the vector representations for each fault).		P
	If the programmable voltage source is a bi-directional, controlled capable of replicating the influence of short-circuit impedances Z_A, Z_B, Z_C may be omitted.		P
5	Test		P
5.1	Test protocol		P
	The LVRT test protocol is designed to verify that the EUT responds appropriately to voltage drops (due to grid faults). During the test, the EUT shall demonstrate that it can: • Appropriately detect the simulated fault. • Ride through the event and continue operation as specified in the applicable curves. • Not suffer any damage from the event.		P

Clause	Requirement - Test	Result - Remark	Verdict
	The response to the voltage drop specified operating period with two output power ranges a) between 0.1 P_n and 0.3 P_n; b) above 0.9 P_n; and with two fault conditions : c) three-phase drop; d) two-phase drop or single-phase drop. The tests should be carried out at least twice at each test point listed in Table 3.		P

Table 3 – Test specification for LVRT (indicative) *(1 of 2)*

Drop times	Drop depth[b]	Drop phase[c]	EUT output conditions[d]
Single drop	A_1	Three-phase	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
		Two-phase	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
		Two-phase to ground	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
		Single-phase to ground	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
	...	Three-phase	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
		Two-phase	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
		Two-phase to ground	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
		Single-phase to ground	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)

Table 3 *(2 of 2)*

Drop times	Drop depth[b]	Drop phase[c]	EUT output conditions[d]
Double drop[a]	A_1	Three-phase	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
		Two-phase	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
		Two-phase to ground	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
		Single-phase to ground	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
	...	Three-phase	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
		Two-phase	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
		Two-phase to ground	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)
		Single-phase to ground	Full load (above 0,9 P_n)
			Part load (0,1 P_n and 0,3 P_n)

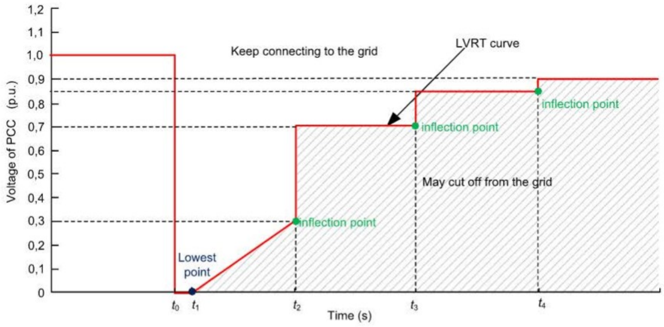
a. Double drop test may be required in some countries or regions. For devices under test not being required for double drop test, above testing points can be omitted.

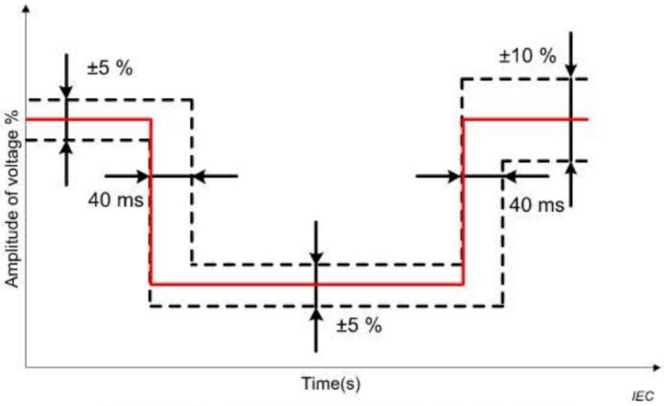
b. Drop depth is the residual voltage during the LVRT testing period which can be decided according 10 the requirement specified by different countries or regions (See Clause B.2 for drop depth ratio calculation.)

c. Drop phase can be decided according 10 the requirement specified by different countries or regions; the value of two-phase voltage should be line voltage.

d. The test should be carried out under specified K-factor provided by local manufacture

Clause	Requirement - Test	Result - Remark	Verdict
5.2	Test curve		P

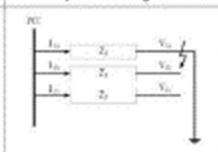
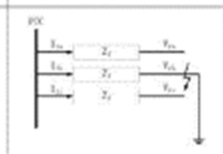
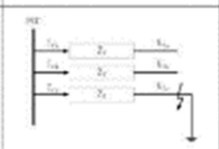
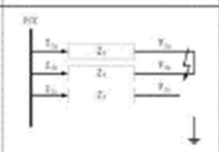
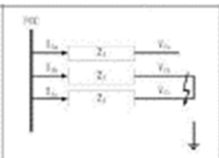
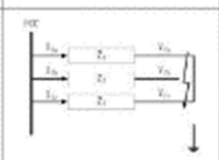
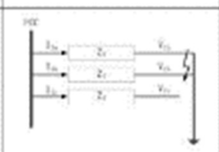
IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
	The LVRT response characteristic shall meet the requirements of the LVRT curve specified by different countries and regions as needed. An example LVRT curve is shown in Figure 4.  **Figure 4 – LVRT curve example**		P
	The example curve shows that the EUT should keep operating during operating conditions indicated in the area above the LVRT curve. Specifically, the EUT should keep operating for ($t_1 – t_0$) seconds without disconnecting from the grid when the interconnection voltage drops to 0 % of rated voltage; for ($t_2 – t_0$) seconds when the voltage drops to 30 % of rated voltage; and for ($t_3 – t_0$) seconds when the voltage drops to 70 % of rated voltage. The EUT should disconnect from the grid during operating conditions indicated within the shaded areas.		P
	The example shows two types of points on the LVRT curve: the lowest point and the inflection point. Tests shall be carried out at both types of points.		P
5.3	Test procedure		P
5.3.1	Pre-test		P
	Prior to the fault simulation tests. the EUT should run in normal operating mode. The selected LVRT curve should be used to identify voltage drop points. including the lowest point and the inflection point. as well as other random points in the curve. Selection of the drop time should follow the requirement of the applicable country or region.		P
5.3.2	No-load test		P
	Prior to the load test, adjust the fault emulator to simulate symmetrical and asymmetrical voltage drops without EUT connection. and validate that the measured results are as intended. This step ensures that the amplitude of voltage and drop duration can match the requirements in Figure 5.		P
5.3.3	Tolerance		P
	The tolerances for drop depth and duration during the no-load test shall reference the requirement of Figure 6 in IEC 61400-21 :2008, and not exceed the values shown in Figure 5		P

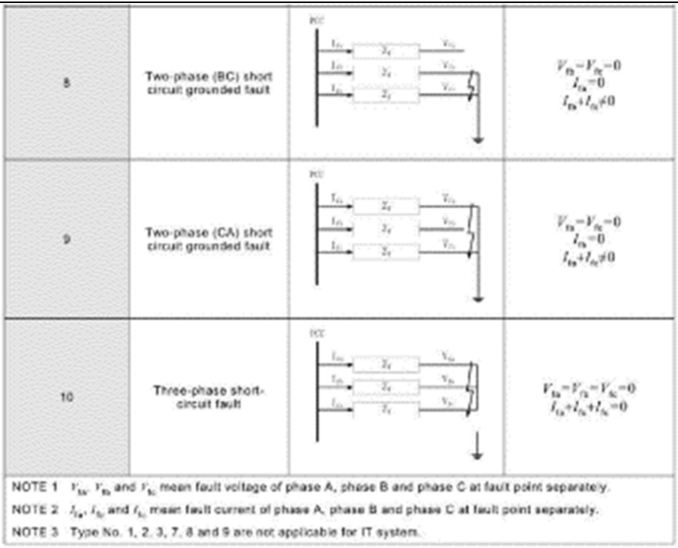
IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
	The tolerance for voltage magnitude is ±5% of rated voltage for the period before and during the voltage drop. The tolerance for voltage magnitude is ±10 % of rated voltage during the period after voltage is recovered. The tolerances shall be measured between 0 and +5 % of rated voltage for the lowest point and the inflection point under no-load conditions.		P
	The duration of each voltage drop is determined according to the requirements of the applicable LVRT curve. The tolerance range for both drop duration and rise time prefers 40ms.  **Figure 5 – Tolerance of voltage drop**		P
5.3.4	Load test		P
	Tests under load shall be carried out after the no-load test results successfully meet the performance requirements. The parameters of the grid fault simulator should be consistent with the no-load test.		P
	With the EUT connected to the grid fault simulator device and the PV simulator (or PV array), the output power should be set to (0.1-0.3) P_n and above $0.9P_n$ separately. Additional load tests at other power levels should be performed as determined by the specific regional requirements.		P
	During the LVRT test, MP1, MP2, and MP3 (shown in Figure 1) shall be selected as the test points for measuring and recording the values of voltage and current.		P
	The waveform and data of the measured voltage and current at the measuring points shall be recorded by the data acquisition device from time A prior to the voltage drop to time B after the subsequent voltage rise. For "A" and "B", specific data should be determined by different countries or regions.		P
6	Assessment criteria		P

IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
	The various assessment criteria is determined by the requirements of the different countries or regions. The characteristics and performance criteria for utilization are shown in Annex B, and can be referenced by a local user.		P

IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
Annex A	Circuit faults and voltage drops (informative)		P
A.1	Fault types		P
	The grid faults of high voltage power transmission line are commonly divided into four different types: single-phase grounded fault, two-phase short circuit fault, two-phase grounded fault, and three-phase short circuit fault. The most common one is the single-phase grounded fault, which accounting for over 90 % of the total number of the faults.		P
	Considering the different fault phases, the short circuit paths for all types of fault are shown in Table A.1.		P

Table A.1 – Short-circuit paths for different fault types

Type No.	Short circuit type	Equivalent diagram	Mathematical formulae
1	Single-phase (A) short circuit grounded fault		$V_{fa}=0$ $I_{fa}\neq0$ $I_{fb}=I_{fc}=0$
2	Single-phase (B) short circuit grounded fault		$V_{fb}=0$ $I_{fb}\neq0$ $I_{fa}=I_{fc}=0$
3	Single-phase (C) short circuit grounded fault		$V_{fc}=0$ $I_{fc}\neq0$ $I_{fa}=I_{fb}=0$
4	Two-phase (AB) short circuit isolated fault		$V_{fa}=V_{fb}\neq0$ $I_{fc}=0$ $I_{fa}+I_{fb}=0$
5	Two-phase (BC) short circuit isolated fault		$V_{fb}=V_{fc}\neq0$ $I_{fa}=0$ $I_{fb}+I_{fc}=0$
6	Two-phase (CA) short circuit isolated fault		$V_{fa}=V_{fc}\neq0$ $I_{fb}=0$ $I_{fa}+I_{fc}=0$
7	Two-phase (AB) short circuit grounded fault		$V_{fa}=V_{fb}=0$ $I_{fc}=0$ $I_{fa}+I_{fb}\neq0$

IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
			P

8	Two-phase (BC) short circuit grounded fault		$V_{fb}=V_{fc}=0$ $I_{fa}=0$ $I_{fb}+I_{fc}\neq0$
9	Two-phase (CA) short circuit grounded fault		$V_{fa}=V_{fc}=0$ $I_{fb}=0$ $I_{fa}+I_{fc}\neq0$
10	Three-phase short-circuit fault		$V_{fa}=V_{fb}=V_{fc}=0$ $I_{fa}+I_{fb}+I_{fc}=0$

NOTE 1 V_{fa}, V_{fb} and V_{fc} mean fault voltage of phase A, phase B and phase C at fault point separately.

NOTE 2 I_{fa}, I_{fb} and I_{fc} mean fault current of phase A, phase B and phase C at fault point separately.

NOTE 3 Type No. 1, 2, 3, 7, 8 and 9 are not applicable for IT system.

A.2	Voltage drops		P
A .2.1	General		P
	When a fault occurs, the voltage amplitude in the faulted phase should be decreased. When a fault occurs between two phases, the phase angle should be changed on inverter output side. Due to the different types of line-transformer connections, the magnitude and phase of inverter AC voltage will vary. Figure A.1 shows the circuit topology under the fault condition.		P

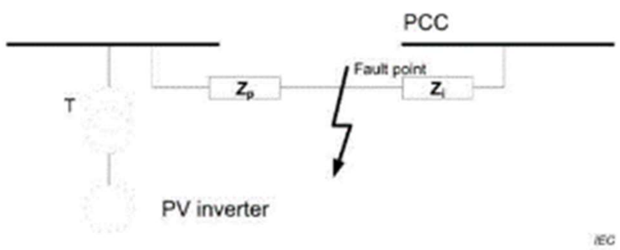


Figure A.1 – Grid fault diagram

As indicated in Table A.1, the value of fault phase voltage at the fault point is zero. (If the grid fault type is two-phase short circuit fault without ground, the line voltage between two fault phases should be zero.) Because PCC is the common connection point of the infinite grid, Z_i between the fault point and PCC could be treated as infinite. The voltage drop amplitude and phase deviation in PV inverter AC side have been determined by the value of Z_p and type of transformer.

Clause	Requirement - Test	Result - Remark	Verdict
	The transformer "T" represents the voltage and phase transformation being equivalent to all the transformers between the fault point and the PV inverter, because one or more transformers are connected. The equivalent transformer "T" has only two types -Y/Y or Y/Δ. In order to simplify the analysis, the transformer windings could be considered as one of two types, Yn/Yn12 and Δ/Yn11, with a ratio of 1.		P
A.2.2	Three-phase short-circuit fault		P
	Figure A.2 illustrates the change in inverter AC voltage magnitude and phase when a three phase short-circuit fault occurs:		P

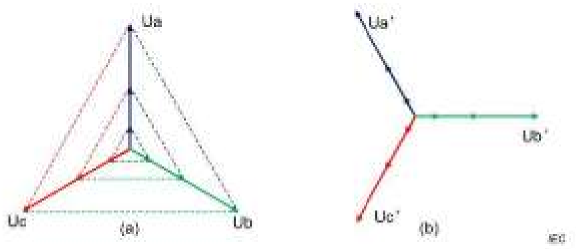


Figure A.2 – Diagram of voltage vector for three-phase short-circuit fault

Clause	Requirement - Test	Result - Remark	Verdict
	Figure A.2(a) shows the angle and phase state with a Yn/Yn12 transformer connection. Figure A.2(b) shows the angle and phase state with a Δ/Yn11 transformer connection. The corresponding relationship between the fault phase and the other two phases is shown in the following Table A .2.		P

Table A.2 – Amplitude and phase changes in three-phase short-circuit fault

Residual voltage of fault phase	With the Yn/Yn12 transformer						With the Δ/Yn11 transformer					
	Phase A		Phase B		Phase C		Phase A		Phase B		Phase C	
%	Am.	Ph.	Am.	Ph.	Am.	Ph.	Am.	Ph.	Am.	Ph.	Am.	Ph.
100	1	0	1	0	1	0	1	30	1	30	1	30
50	0,5	0	0,5	0	0,5	0	0,5	30	0,5	30	0,5	30
20	0,2	0	0,2	0	0,2	0	0,2	30	0,2	30	0,2	30
0	0	–	0	–	0	–	0	–	0	–	0	–

NOTE Am. means amplitude and Ph. means the initial phase.

Clause	Requirement - Test	Result - Remark	Verdict
A .2.3	Two-phase short-circuit fault with ground		P
	There are three possible two-phase short-circuit earth faults, depending on the fault phases. Taking the two-phase (BC) short circuit fault with ground for example, the change in inverter AC voltage amplitudes and phases are shown below:		P

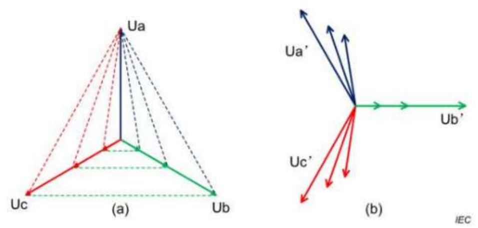


Figure A.3 – Diagram of voltage vector of two-phase (BC) short-circuit fault with ground

IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
	Figure A.3(a) shows the angle and phase state with a Yn/Yn12 transformer connection. Figure A.3(b) shows the angle and phase state with a Δ/Yn11 transformer connection. The corresponding relationship between the fault phase and the other two phases is shown in the following Table A.3.		P

Table A.3 – Amplitude and phase changes in two-phase (BC) short-circuit fault with ground

Residual voltage of fault phase	With the Yn/Yn12 transformer						With the Δ/Yn11 transformer					
	Phase A		Phase B		Phase C		Phase A		Phase B		Phase C	
%	Am.	Ph.	Am.	Ph.	Am.	Ph.	Am.	Ph.	Am.	Ph.	Am.	Ph.
100	1	0	1	0	1	0	1	30	1	30	1	30
50	1	0	0,5	0	0,5	0	0,76	19	0,5	30	0,76	41
20	1	0	0,2	0	0,2	0	0,64	9	0,2	30	0,64	51
0	1	0	0	–	0	–	0,58	0	0	–	0,58	60

NOTE Am. means amplitude and Ph. means the initial phase.

Clause	Requirement - Test	Result - Remark	Verdict
A .2.4	Two-phase short-circuit fault without ground		P
	There are three possible two-phase short-circuit earth faults, depending on the fault phases. Taking the two-phase (BC) short circuit fault for example, the change in inverter AC voltage amplitudes and phases are shown below:		P

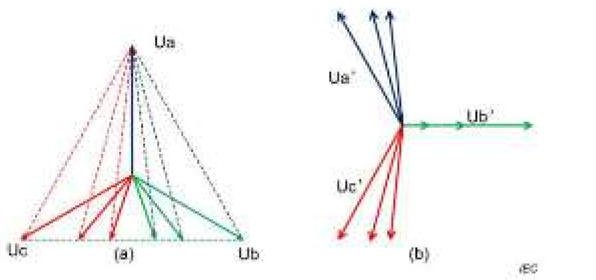


Figure A.4 – Diagram of voltage vector of two-phase (BC) short-circuit fault

Clause	Requirement - Test	Result - Remark	Verdict
	Figure A.4(a) shows the angle and phase state with a Yn/Yn12 transformer connection. Figure A.4(b) shows the angle and phase state with a Δ/Yn11 transformer connection. The corresponding relationship between the fault phase and the other two phases is shown in the following Table A.4.		P

Table A.4 – Amplitude and phase changes in two-phase (BC) short-circuit fault

Residual voltage of fault phase	With the Yn/Yn12 transformer						With the Δ/Yn11 transformer					
	Phase A		Phase B		Phase C		Phase A		Phase B		Phase C	
%	Am.	Ph.	Am.	Ph.	Am.	Ph.	Am.	Ph.	Am.	Ph.	Am.	Ph.
100	1	0	1	0	1	0	1	30	1	30	1	30
50	1	0	0,66	19	0,66	-19	0,9	16	0,5	30	0,9	44
20	1	0	0,53	41	0,53	-41	0,87	7	0,2	30	0,87	53
0	1	0	0,5	60	0,5	-60	0,866	0	0	-	0,866	60

NOTE Am. means amplitude and Ph. means the initial phase.

Clause	Requirement - Test	Result - Remark	Verdict
A .2.5	Single-phase short-circuit fault with ground		P

IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
	There are three possible single-phase short-circuit faults to ground, depending on the fault phases. Taking the single-phase A) short circuit fault for example, the change in inverter AC voltage amplitudes and phases are shown below:		P

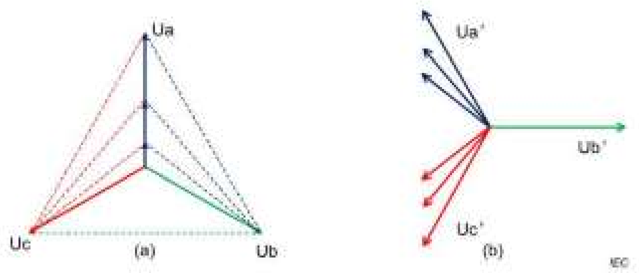


Figure A.5 – Diagram of voltage vector of single-phase (A) short-circuit fault with ground

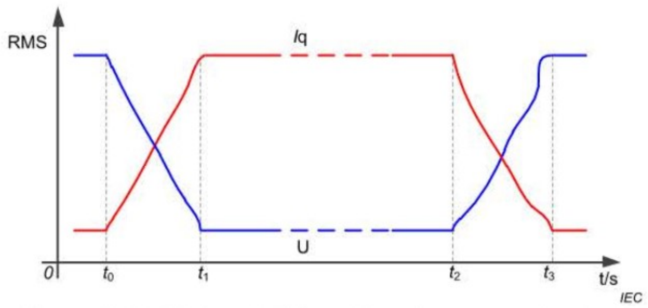
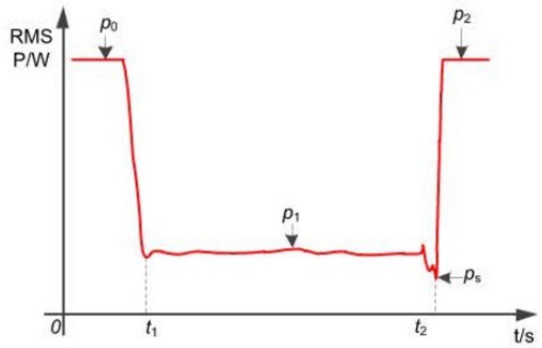
Clause	Requirement - Test	Result - Remark	Verdict
	Figure A.5(a) shows the angle and phase state with a Yn/Yn12 transformer connection. Figure A.5(b) shows the angle and phase state with a Δ/Yn11 transformer connection. The corresponding relationship between the fault phase and the other two phases is shown in the following Table A.5.		P

Table A.5 – Amplitude and phase changes in single-phase (A) short-circuit fault with ground

Residual voltage of fault phase	With the Yn/Yn12 transformer						With the Δ/Yn11 transformer					
	Phase A		Phase B		Phase C		Phase A		Phase B		Phase C	
%	Am.	Ph.	Am.	Ph.	Am.	Ph.	Am.	Ph.	Am.	Ph.	Am.	Ph.
100	1	0	1	0	1	0	1	30	1	30	1	30
50	0,5	0	1	0	1	0	0,76	41	0,5	30	0,76	19
20	0,2	0	1	0	1	0	0,64	51	0,2	30	0,64	9
0	1	0	1	0	1	0	0,58	60	0	–	0,58	0

NOTE Am. means amplitude and Ph. means the initial phase.

IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
Annex B	Determination of critical performance values in LVRT testing (informative)		P
B.1	General		P
	This Annex provides suggested methods for determining several of the critical performance values in LVRT testing. Different countries and regions may choose alternate methods according to the requirements of their standards.		P
B.2	Drop depth ratio.		P
	As the voltage of the test circuit may deviate from the nominal voltage of system, the rated voltage of the EUT should be used as the reference voltage for calculations of the voltage drop depth ratio, as shown in Formula B.1. As such it is not recommended to use the value of the actual voltage measured prior to the drop test to calculate drop depth. $A_n = \frac{U_{dip}}{U_n}$ (B.1) where A_n is the residual voltage ratio; U_{dip} is the actual voltage during the drop test; U_n is the rated AC voltage of EUT.		P
8.3	Ride-through time		P
	Over the voltage drop period, the EUT shall meet the ride through time requirements corresponding with the applicable voltage drop depths. These requirements will differ depending on countries and regions, however, the LVRT performance should meet or exceed the most demanding requirements for the specified region. LVRT functions tested successfully according to specific ride through requirements should only be applied in corresponding countries and regions where those requirements are applicable.		P
B.4	Reactive current	As require by applicant, reactive current is not requirement over the duration of the voltage drop.	N/A
	If the EUT generates reactive current as a function of voltage drop depth over the duration of the voltage drop, the incremental voltage changes in the un-fault phases caused by the increased reactive current shall not exceed any values specified by the most demanding requirements of the different countries or regions.		N/A

IEC TS 62910			
Clause	Requirement - Test	Result - Remark	Verdict
	If it is required that the reactive output current of the EUT should change dynamically according to the voltage change during the drop period, the time period for estimating the value of reactive current should be selected between the beginning of the voltage drop and the beginning of the voltage recovery. This is shown as the time between t_1 and t_2 in Figure B.1. In general, time period between t_2 and t_3 is not over 20 ms.  **Figure B.1 – Determination of reactive current output** The output of reactive current may fluctuate during test. This fluctuation may result in reactive current values that are higher or lower than the standard requirement during the test, especially during the voltage drop period. Therefore, the reactive current value measurement should be averaged over the whole drop period.		N/A
B.5	Active power		P
	If active power control characteristics are required by the local standard during LVRT events, it is necessary to characterize active powers (p_0) before, during (p_1) and after (p_2) the voltage drop, as shown in Figure B.2.		P
	Active power (p_1) may fluctuate during the voltage drop interval, especially at point (p_s) where system voltage recovery begins. It is therefore misleading to use the value of active power recorded at p_s for active power control assessment. It is suggested instead that an average value of active power be determined over the time between t_1 and t_2 to assess the characteristics of active power recovery  **Figure B.2 – Determination of active power recovery**		P

5.3.1 Pre-test (Grid simulator setting)									P
Figure	Fault Depth	Fault Duration (ms)	L1		L2		L3		Pos.pu
			pu	Degree	pu	Degree	pu	Degree	
A.2.2 (b)	5%	250	0.05	0	0.05	240	0.05	120	0.050
	20%	770	0.20	0	0.20	240	0.20	120	0.200
	50%	1800	0.50	0	0.50	240	0.50	120	0.500
	85%	3000	0.85	0	0.85	240	0.85	120	0.850
A.2.3 (b)	5%	250	0.05	0	0.59	268	0.59	92	0.366
	20%	770	0.20	0	0.64	261	0.64	99	0.467
	50%	1800	0.50	0	0.76	251	0.76	109	0.666
	85%	3000	0.85	0	0.93	243	0.93	117	0.900
A.2.4 (b)	5%	250	0.05	0	0.87	268	0.87	92	0.521
	20%	770	0.20	0	0.87	263	0.87	97	0.600
	50%	1800	0.50	0	0.90	254	0.90	106	0.750
	85%	3000	0.85	0	0.97	244	0.97	116	0.925
A.2.5 (b)`	5%	250	1.00	0	0.59	212	0.59	148	0.683
	20%	770	1.00	0	0.64	218	0.64	142	0.733
	50%	1800	1.00	0	0.76	229	0.76	131	0.833
	85%	3000	1.00	0	0.92	237	0.92	123	0.950

Note:
Δ/Yn11 transformer connection shows the angle and phase state of A.2.2(b), A.2.3(b), A.2.4(b), A.2.5(b).
SC: short circuit
SC-GND: short circuit with ground
SC(no ground): short circuit without ground

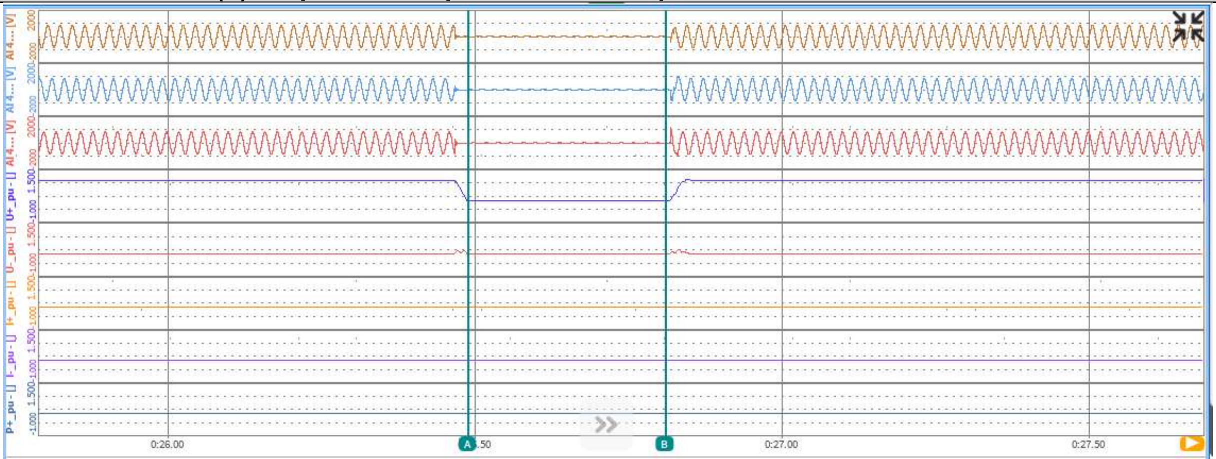
5.3.2(b)	No load Test (△/Yn11 transformer)						P
Model: SG3125HV-32							
Test	Voltage Depth [pu]	Fault type	Measured voltage. Pos [pu]	Fault duration [ms]			Verdict
				Drop	Maintain	Restore	
2.1.1	0.05	A.2.2 (b)	0.048	16.1	321	19.0	P
2.1.2		A.2.3 (b)	0.365	19.8	431	17.5	P
2.1.3		A.2.4 (b)	0.520	16.0	419	19.7	P
2.1.4		A.2.5 (b)	0.677	18.4	415	19.7	P
2.2.1	0.20	A.2.2 (b)	0.211	19.6	870	16.8	P
2.2.2		A.2.3 (b)	0.460	14.7	961	18.3	P
2.2.3		A.2.4 (b)	0.593	18.2	962	15.9	P
2.2.4		A.2.5 (b)	0.722	18.2	950	18.2	P
2.3.1	0.50	A.2.2 (b)	0.500	13.2	1930	27.5	P
2.3.2		A.2.3 (b)	0.658	13.2	1920	17.5	P
2.3.3		A.2.4 (b)	0.745	19.3	1890	19.2	P
2.3.4		A.2.5 (b)	0.829	14.0	1860	17.5	P
2.4.1	0.85	A.2.2 (b)	0.850	14.9	3110	14.9	P
2.4.2		A.2.3 (b)	0.899	14.0	3103	14.1	P
2.4.3		A.2.4 (b)	0.925	16.1	3082	14.1	P
2.4.4		A.2.5 (b)	0.947	16.7	3085	16.7	P

5.4.3(b)	LVRT Test (Load test - △/Yn11 transformer connection)					P
Model: SG3125HV-32						
Appendix: Annex D (Load test)						
Test	**Voltage Depth [pu]**	**Fault type**	**Fault duration [ms]**	**P set point [P_{rE}]**	**Set point [Ki]**	**P/F**
5.1.1	0.05	A.2.2 (b)	250	20%	2	P
5.1.2				100%		P
5.1.3		A.2.3 (b)	250	20%		P
5.1.4				100%		P
5.1.5		A.2.4 (b)	250	20%		P
5.1.6				100%		P
5.1.7		A.2.5 (b)	250	20%		P
5.1.8				100%		P
5.2.1	0.20	A.2.2 (b)	770	20%	2	P
5.2.2				100%		P
5.2.3		A.2.3 (b)	770	20%		P
5.2.4				100%		P
5.2.5		A.2.4 (b)	770	20%		P
5.2.6				100%		P
5.2.7		A.2.5 (b)	770	20%		P
5.2.8				100%		P
5.3.1	0.50	A.2.2 (b)	1800	20%	2	P
5.3.2				100%		P
5.3.3		A.2.3 (b)	1800	20%		P
5.3.4				100%		P
5.3.5		A.2.4 (b)	1800	20%		P
5.3.6				100%		P
5.3.7		A.2.5 (b)	1800	20%		P
5.3.8				100%		P
5.4.1	0.85	A.2.2 b	3000	20%	2	P
5.4.2				100%		P
5.4.3		A.2.3 b	3000	20%		P
5.4.4				100%		P
5.4.5		A.2.4 b	3000	20%		P
5.4.6				100%		P
5.4.7		A.2.5 b	3000	20%		P
5.4.8				100%		P

5.1(b)	LVRT Test (△/Yn11 transformer)					P
Model	SG3125HV-32					
Test number	Required fault		Measured fault		Percentage of current after fault [%Ir]	Duration of restoring settling [ms]
	Voltage pos. [pu]	Duration [ms]	Voltage pos. [pu]	Duration [ms]		
5.1.1	0.05	250	0.061	359	103	82
5.1.2			0.053	338	104	243
5.1.3			0.390	399	69.2	257
5.1.4			0.389	385	67.0	298
5.1.5			0.539	421	44.2	43
5.1.6			0.539	394	46.1	267
5.1.7			0.693	371	49.4	110
5.1.8			0.693	371	50.5	277
5.2.1	0.20	770	0.211	827	107	65
5.2.2			0.231	834	108	272
5.2.3			0.487	919	68.8	111
5.2.4			0.486	923	66.0	306
5.2.5			0.613	916	49.8	142
5.2.6			0.611	912	49.6	247
5.2.7			0.742	914	51.4	108
5.2.8			0.742	905	51.6	292
5.3.1	0.50	1650	0.513	1880	103	140
5.3.2			0.525	1912	100	237
5.3.3			0.687	1910	64	135
5.3.4			0.689	1864	64	282
5.3.5			0.764	1873	49	145
5.3.6			0.764	1870	49	255
5.3.7			0.839	1834	30	105
5.3.8			0.841	1810	31	130
5.4.1	0.85	3000	0.850	3022	29	215
5.4.2			0.855	3080	31	145
5.4.3			0.909	3045	19	175
5.4.4			0.912	3093	19	102
5.4.5			0.930	3028	14.1	178
5.4.6			0.937	3057	14.2	122
5.4.7			0.952	3088	10.1	156
5.4.8			0.957	3082	10.1	114

Test 2.1.1

A.2.2(b): Depth of fault phase:5%, three-phase SC fault, △/Yn11, 0% load



	A	B	Delta
Time [s]	0:26.48881	0:26.81012	0.32131
AI 4/U1 [V]	-1.717329	6.264687	7.982016
AI 4/U2 [V]	4.248381	18.78524	14.53686
AI 4/U3 [V]	-2.587319	-25.08474	-22.49742
U+_pu []	0.018085	0.029012	0.010927
U-_pu []	0.014733	3.207e-4	-0.014413
I+_pu []	8.925e-6	1.110e-5	2.177e-6
I-_pu []	-5.653e-6	9.417e-6	1.507e-5
P+_pu []	1.097e-6	1.605e-7	-9.361e-7

Test 2.1.2

A.2.3(b): Depth of fault phase:5%, two-phase SC-GND, △/Yn11, 0% load

	A	B	Delta
Time [s]	0:29.06800	0:29.49956	0.43155
AI 4/U1 [V]	-270.5646	354.0213	624.5859
AI 4/U2 [V]	-253.3233	485.9171	739.2405
AI 4/U3 [V]	523.7449	-840.1547	-1363.900
U+_pu []	0.365295	0.366690	1.396e-3
U-_pu []	0.315333	0.318808	3.475e-3
I+_pu []	7.892e-5	6.728e-5	-1.164e-5
I-_pu []	2.705e-5	6.153e-5	3.448e-5
P+_pu []	-8.317e-6	-9.641e-6	-1.324e-6
P-_pu []	4.939e-6	2.112e-6	-2.828e-6
Q+_pu []	2.883e-5	2.467e-5	-4.157e-6
Q-_pu []	8.532e-6	1.962e-5	1.109e-5

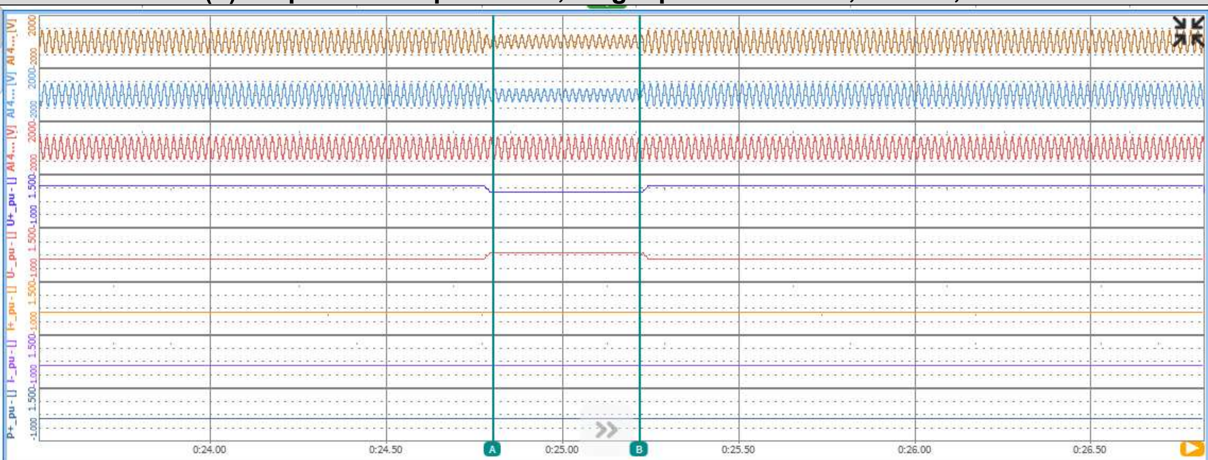
Test 2.1.3

A.2.4(b): Depth of fault phase:5%, two-phase SC(no ground), △/Yn11, 0% load

	A	B	Delta
Time [s]	0:29.03215	0:29.45204	0.41989
AI 4/U1 [V]	-221.1535	-208.8676	12.28595
AI 4/U2 [V]	-153.0242	-144.4762	8.548022
AI 4/U3 [V]	374.1820	353.3507	-20.83135
U+_pu []	0.520598	0.525687	5.089e-3
U-_pu []	0.469828	0.475398	5.571e-3
I+_pu []	1.067e-4	1.092e-4	2.489e-6
I-_pu []	9.174e-5	1.008e-4	9.030e-6
P+_pu []	-6.247e-5	-7.453e-5	-1.206e-5
P-_pu []	-3.744e-5	-4.757e-5	-1.013e-5
Q+_pu []	5.554e-5	5.739e-5	1.851e-6
Q-_pu []	4.311e-5	4.791e-5	4.804e-6

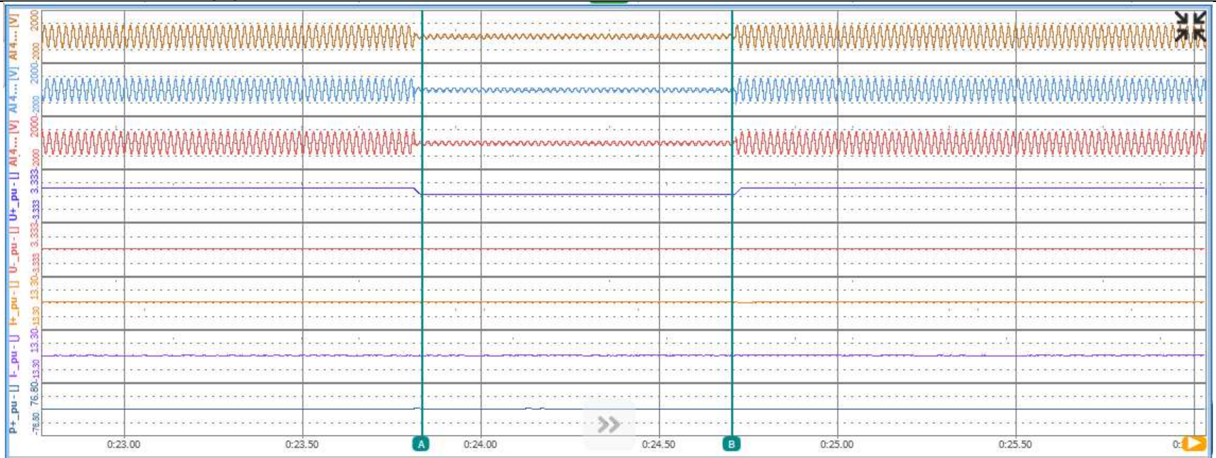
Test 2.1.4

A.2.5(b): Depth of fault phase:5%, single-phase SC-GND, △/Yn11, 0% load



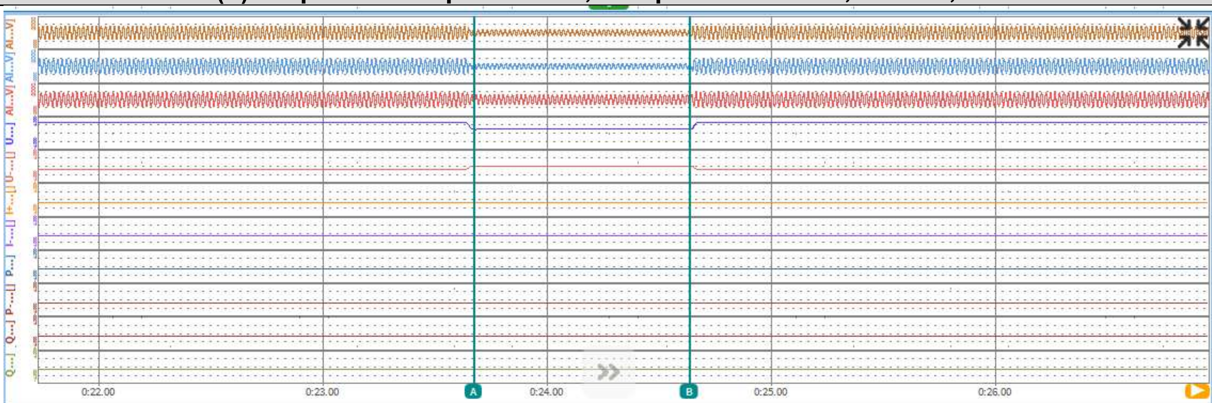
	A	B	Delta
Time [s]	0:24.80277	0:25.21860	0.41584
AI 4/U1 [V]	309.0732	-288.0438	-597.1170
AI 4/U2 [V]	-228.9190	-488.6837	-259.7647
AI 4/U3 [V]	-80.18733	776.5642	856.7515
U+_pu []	0.677595	0.677857	2.616e-4
U-_pu []	0.312820	0.314620	1.801e-3
I+_pu []	1.461e-4	1.561e-4	9.930e-6
I-_pu []	5.903e-5	7.285e-5	1.382e-5
P+_pu []	-3.154e-5	-2.497e-5	6.573e-6

Test 2.2.1
A.2.2(b): Depth of fault phase:20%, three-phase SC fault, △/Yn11, 0% load



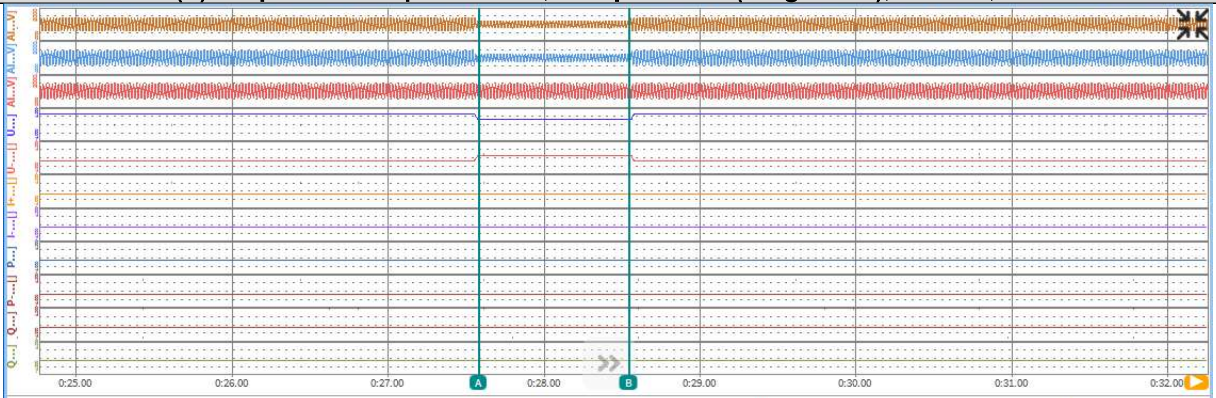
	A	B	Delta
Time [s]	0:23.83533	0:24.70588	0.87055
AI 4/U1 [V]	79.63801	-99.94531	-179.5833
AI 4/U2 [V]	-160.7227	167.8643	328.5871
AI 4/U3 [V]	81.13790	-67.80219	-148.9401
U+_pu []	0.211224	0.200097	-0.011127
U-_pu []	4.585e-3	1.268e-3	-3.317e-3
I+_pu []	3.805e-5	4.387e-5	5.818e-6
I-_pu []	2.785e-5	5.953e-6	-2.189e-5
P+_pu []	6.195e-6	-3.144e-6	-9.339e-6

Test 2.2.2
A.2.3(b): Depth of fault phase:20%, two-phase SC-GND, △/Yn11, 0% load



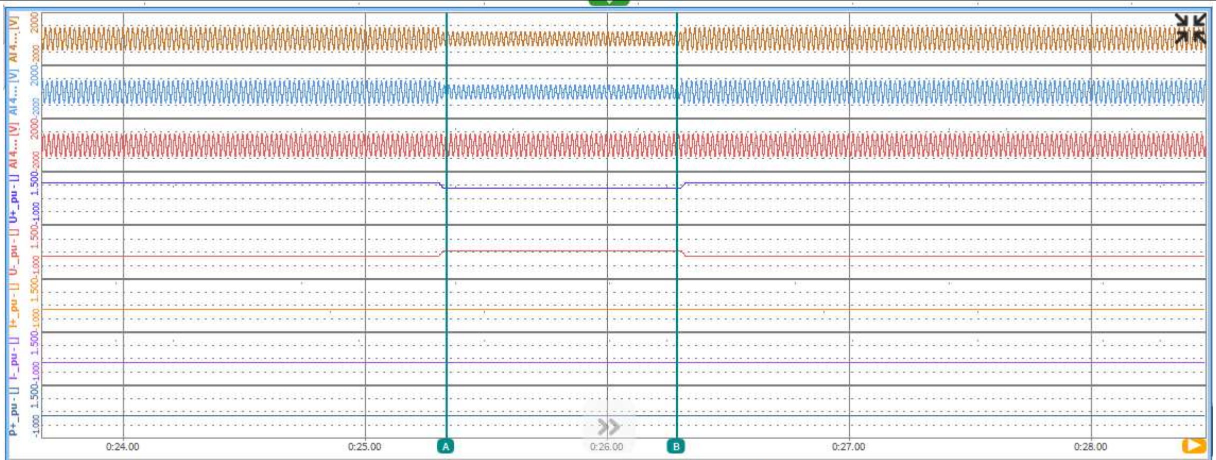
	A	B	Delta
Time [s]	0:23.672894	0:24.634272	0.961378
AI 4/U1 [V]	312.7067	225.4222	-87.28457
AI 4/U2 [V]	296.2115	339.1369	42.92536
AI 4/U3 [V]	-608.8789	-564.9798	43.89906
U+_pu []	0.460938	0.462343	1.405e-3
U-_pu []	0.263133	0.265204	2.071e-3
I+_pu []	1.047e-4	1.121e-4	7.496e-6
I-_pu []	4.951e-5	6.013e-5	1.062e-5
P+_pu []	-1.387e-5	-1.499e-5	-1.124e-6
P-_pu []	-5.577e-7	4.365e-7	9.941e-7
Q+_pu []	4.824e-5	5.185e-5	3.613e-6
Q-_pu []	1.303e-5	1.595e-5	2.920e-6

Test 2.2.3
A.2.4(b): Depth of fault phase:20%, two-phase SC(no ground), △/Yn11, 0% load



	A	B	Delta
Time [s]	0:27.58375	0:28.54629	0.96254
AI 4/U1 [V]	427.5100	361.6178	-65.89222
AI 4/U2 [V]	298.2900	446.9004	148.6104
AI 4/U3 [V]	-725.9055	-808.6291	-82.72362
U+_pu []	0.593701	0.595437	1.735e-3
U-_pu []	0.393626	0.396410	2.783e-3
I+_pu []	1.228e-4	1.552e-4	3.238e-5
I-_pu []	4.411e-5	6.118e-5	1.707e-5
P+_pu []	-5.790e-5	-9.390e-5	-3.600e-5
P-_pu []	-3.743e-5	-4.250e-5	-5.071e-6
Q+_pu []	7.294e-5	9.243e-5	1.949e-5
Q-_pu []	1.737e-5	2.426e-5	6.889e-6

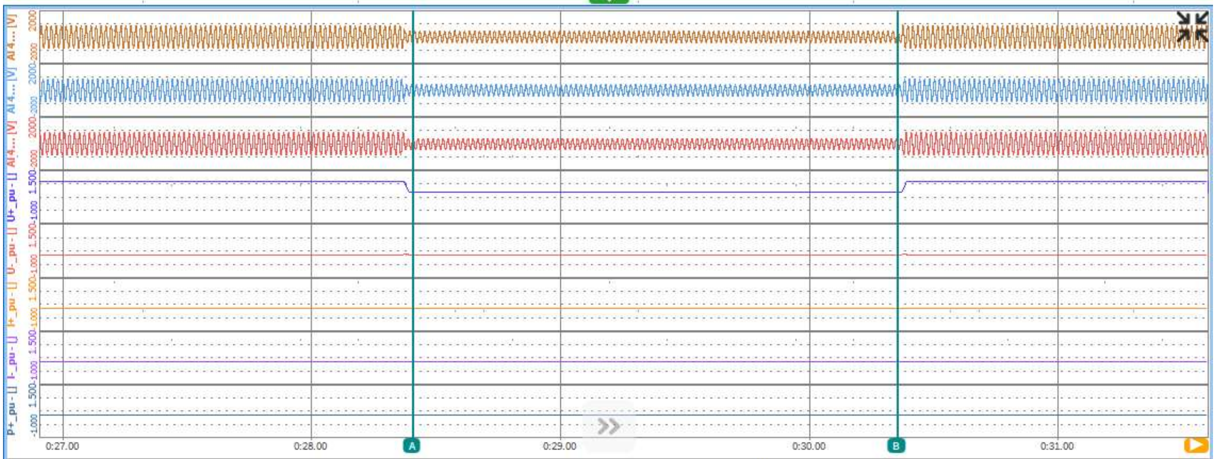
Test 2.2.4
A.2.5(b): Depth of fault phase:20%, single-phase SC-GND, △/Yn11, 0% load



	A	B	Delta
Time [s]	0:25.33754	0:26.28820	0.95066
AI 4/U1 [V]	-477.1397	415.0355	892.1753
AI 4/U2 [V]	-341.1837	425.5867	766.7704
AI 4/U3 [V]	818.4302	-840.8647	-1659.295
U+_pu []	0.722162	0.726784	4.623e-3
U-_pu []	0.265540	0.264504	-1.036e-3
I+_pu []	1.586e-4	1.641e-4	5.595e-6
I-_pu []	4.382e-5	5.073e-5	6.912e-6
P+_pu []	-2.511e-5	-3.537e-5	-1.027e-5

Test 2.3.1

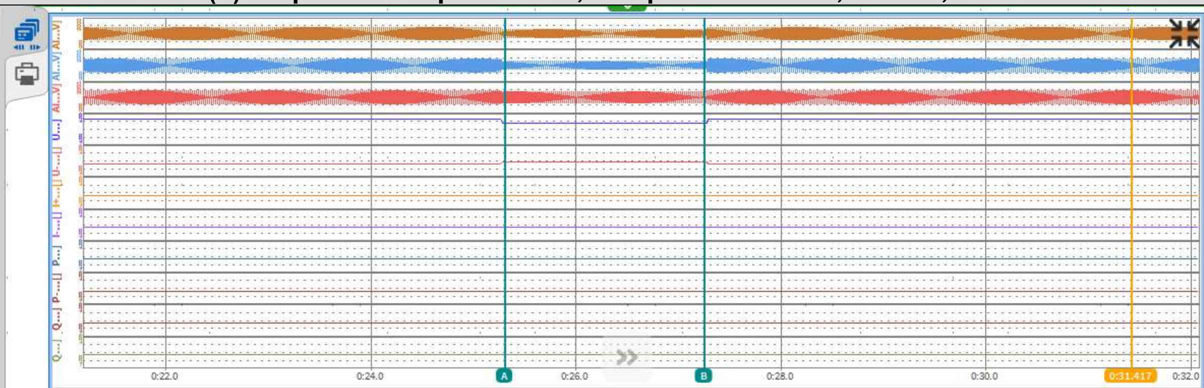
A.2.2(b): Depth of fault phase:50%, three-phase SC fault, △/Yn11, 0% load



	A	B	Delta
Time [s]	0:28.40636	0:30.35348	1.94711
AI 4/U1 [V]	-367.8193	63.06339	430.8827
AI 4/U2 [V]	366.5679	-393.9464	-760.5143
AI 4/U3 [V]	1.243115	330.8974	329.6542
U+_pu []	0.485005	0.499165	0.014160
U-_pu []	1.671e-3	7.001e-4	-9.709e-4
I+_pu []	1.010e-4	1.121e-4	1.113e-5
I-_pu []	-2.336e-6	-1.297e-5	-1.063e-5
P+_pu []	-9.991e-6	-8.292e-6	1.699e-6

Test 2.3.2

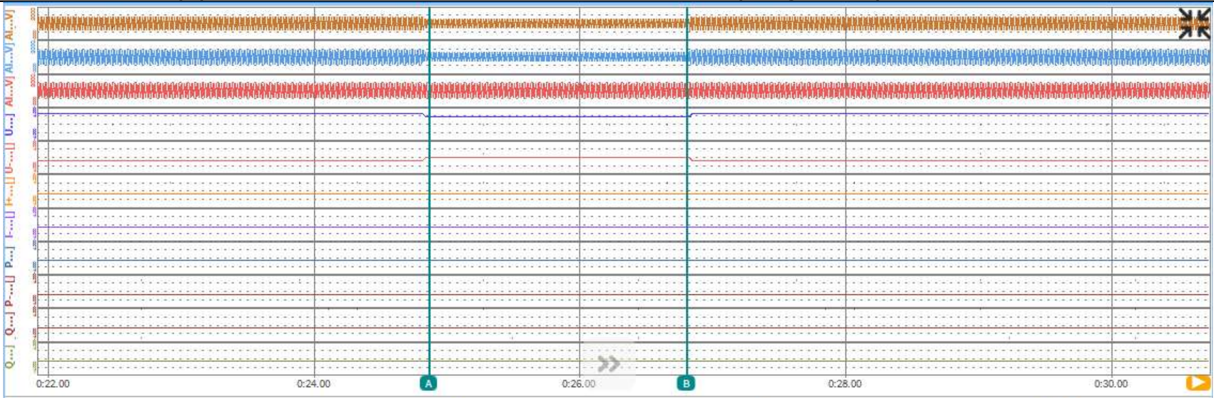
A.2.3(b): Depth of fault phase:50%, two-phase SC-GND, △/Yn11, 0% load



	A	B	Delta
Time [s]	0:25.30845	0:27.25207	1.94362
AI 4/U1 [V]	493.2037	303.2127	-189.9910
AI 4/U2 [V]	-122.9498	396.3015	519.2514
AI 4/U3 [V]	-370.0915	-699.9200	-329.8285
U+_pu []	0.659986	0.664693	4.708e-3
U-_pu []	0.170741	0.168299	-2.442e-3
I+_pu []	1.514e-4	1.596e-4	8.174e-6
I-_pu []	3.688e-5	2.853e-5	-8.354e-6
P+_pu []	-2.327e-5	-2.314e-5	1.292e-7
P-_pu []	1.428e-6	1.210e-6	-2.178e-7
Q+_pu []	9.992e-5	1.061e-4	6.146e-6
Q-_pu []	6.298e-6	4.802e-6	-1.496e-6

Test 2.3.3

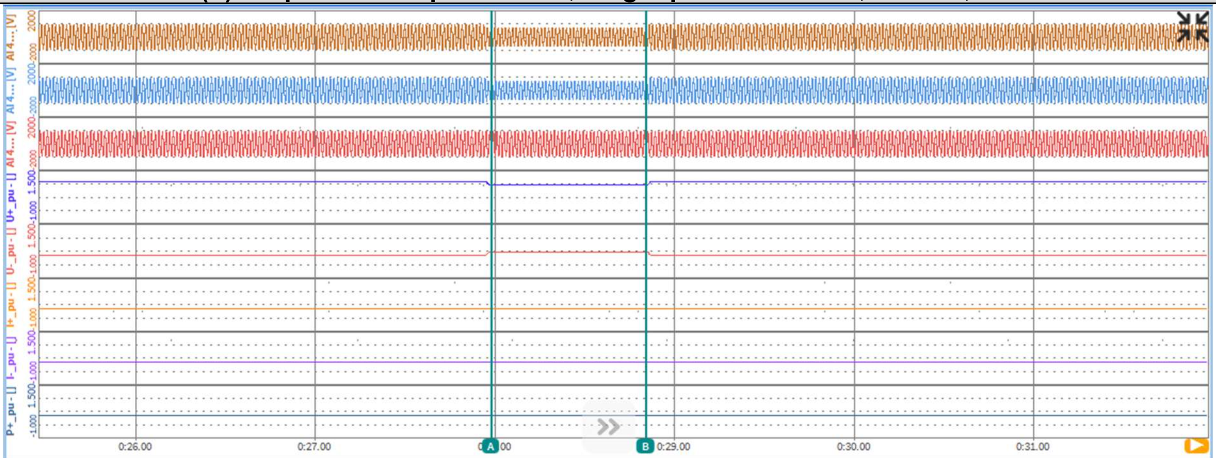
A.2.4(b): Depth of fault phase:50%, two-phase SC(no ground), △/Yn11, 0% load



	A	B	Delta
Time [s]	0:24.86869	0:26.80338	1.93468
AI 4/U1 [V]	-167.8996	539.4907	707.3904
AI 4/U2 [V]	505.2369	198.7822	-306.4547
AI 4/U3 [V]	-337.3783	-738.4046	-401.0263
U+_pu []	0.739270	0.745412	6.141e-3
U-_pu []	0.247659	0.246243	-1.416e-3
I+_pu []	1.852e-4	1.866e-4	1.427e-6
I-_pu []	4.944e-5	9.873e-7	-4.846e-5
P+_pu []	-9.071e-5	-1.331e-4	-4.242e-5
P-_pu []	-1.999e-5	-1.965e-5	3.393e-7
Q+_pu []	1.369e-4	1.391e-4	2.201e-6
Q-_pu []	1.225e-5	2.431e-7	-1.200e-5

Test 2.3.4

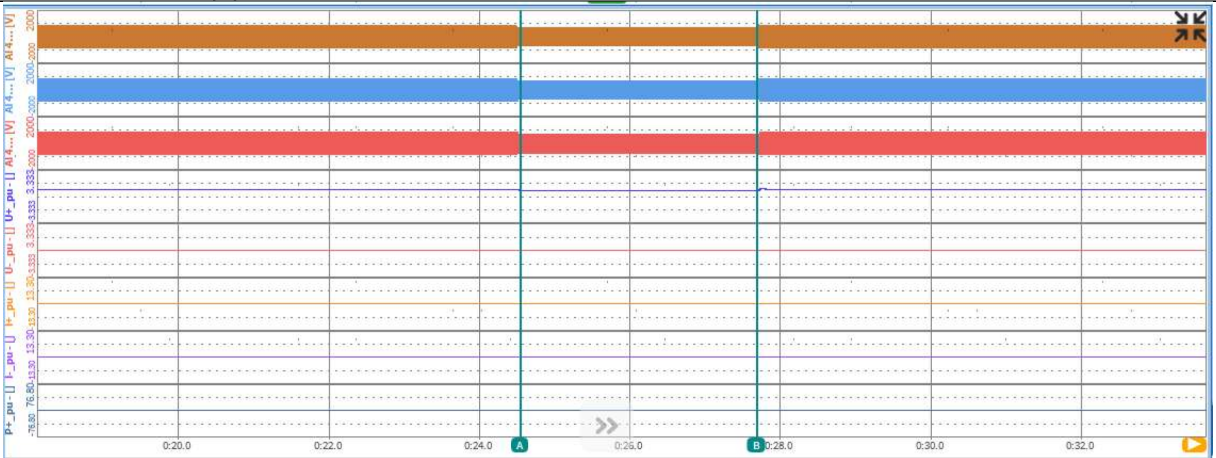
A.2.5(b): Depth of fault phase:50%, single-phase SC-GND, △/Yn11, 0% load



	A	B	Delta
Time [s]	0:27.98237	0:29.84335	1.86099
AI 4/U1 [V]	684.7604	709.3263	24.56594
AI 4/U2 [V]	-274.1473	-58.69079	215.4565
AI 4/U3 [V]	-410.8444	-650.7402	-239.8958
U+_pu []	0.829791	0.833101	3.310e-3
U-_pu []	0.167719	0.167443	-2.761e-4
I+_pu []	2.091e-4	2.188e-4	9.634e-6
I-_pu []	9.925e-6	1.796e-5	8.030e-6
P+_pu []	-4.451e-5	-5.016e-5	-5.657e-6

Test 2.4.1

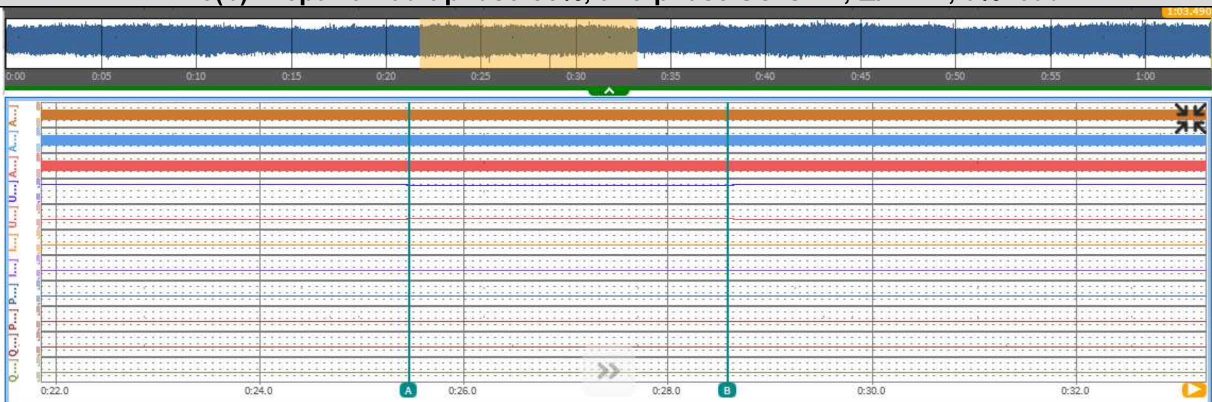
A.2.2(b): Depth of fault phase:85%, three-phase SC fault, △/Yn11, 0% load



	A	B	Delta
Time [s]	0:24.54710	0:27.68700	3.13990
AI 4/U1 [V]	328.9197	320.7846	-8.135081
AI 4/U2 [V]	-715.4582	-721.0875	-5.629301
AI 4/U3 [V]	386.3776	400.4543	14.07671
U+_pu []	0.840715	0.848372	7.658e-3
U-_pu []	6.534e-4	1.239e-3	5.858e-4
I+_pu []	2.040e-4	1.905e-4	-1.352e-5
I-_pu []	-4.051e-6	1.339e-6	5.390e-6
P+_pu []	-4.321e-5	-3.521e-5	7.996e-6

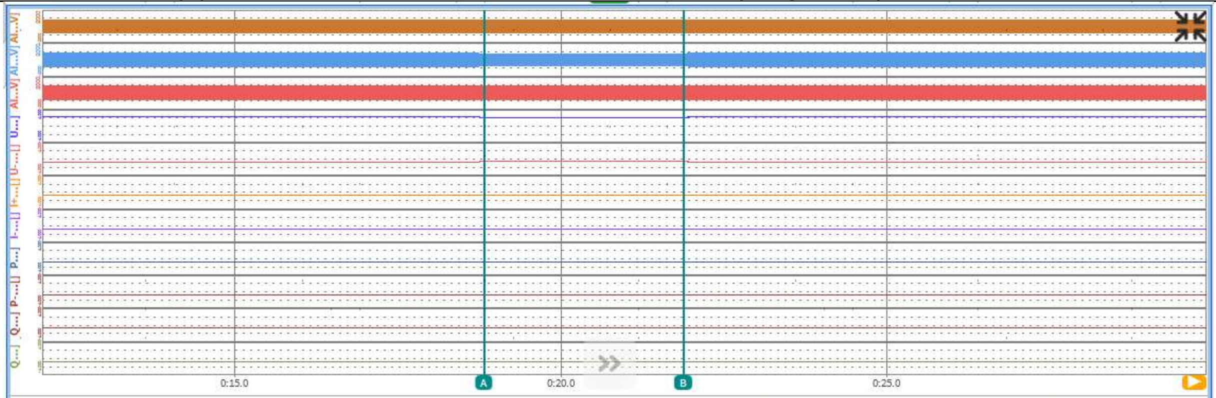
Test 2.4.2

A.2.3(b): Depth of fault phase:85%, two-phase SC-GND, △/Yn11, 0% load



	A	B	Delta
Time [s]	0:25.46495	0:28.58847	3.12351
AI 4/U1 [V]	-712.1220	-143.6555	568.4665
AI 4/U2 [V]	124.9890	-599.8576	-724.8466
AI 4/U3 [V]	587.0400	743.8119	156.7719
U+_pu []	0.891460	0.896110	4.650e-3
U-_pu []	0.048220	0.047336	-8.845e-4
I+_pu []	2.094e-4	1.984e-4	-1.093e-5
I-_pu []	-1.060e-5	-6.257e-6	4.339e-6
P+_pu []	-3.683e-5	-3.535e-5	1.479e-6
P-_pu []	1.030e-6	9.261e-7	-1.038e-7
Q+_pu []	1.866e-4	1.778e-4	-8.820e-6
Q-_pu []	-5.110e-7	-2.962e-7	2.148e-7

Test 2.4.3
A.2.4(b): Depth of fault phase:85%, two-phase SC(no ground), △/Yn11, 0% load



	A	B	Delta
Time [s]	0:18.83597	0:21.89007	3.05409
AI 4/U1 [V]	444.8874	-697.3751	-1142.263
AI 4/U2 [V]	-727.7475	9.608269	737.3558
AI 4/U3 [V]	282.7847	687.8102	405.0255
U+_pu []	0.918856	0.920119	1.264e-3
U-_pu []	0.070052	0.069323	-7.295e-4
I+_pu []	2.015e-4	2.084e-4	6.841e-6
I-_pu []	-9.307e-6	-2.289e-5	-1.358e-5
P+_pu []	-1.337e-4	-1.550e-4	-2.134e-5
P-_pu []	-5.019e-6	-4.486e-6	5.336e-7
Q+_pu []	1.852e-4	1.917e-4	6.549e-6
Q-_pu []	-6.520e-7	-1.587e-6	-9.350e-7

Test 2.4.4
A.2.4(b): Depth of fault phase:85%, single-phase SC-GND, △/Yn11, 0% load

	A	B	Delta
Time [s]	0:24.04933	0:27.22504	3.17571
AI 4/U1 [V]	66.33139	-742.3990	-808.7304
AI 4/U2 [V]	-730.4218	91.75468	822.1765
AI 4/U3 [V]	664.3835	650.7986	-13.58485
U+_pu []	0.955724	0.942434	-0.013290
U-_pu []	0.040611	0.049798	9.186e-3
I+_pu []	1.967e-4	2.160e-4	1.933e-5
I-_pu []	-3.092e-5	-1.007e-5	2.085e-5
P+_pu []	-3.095e-5	-5.382e-5	-2.287e-5

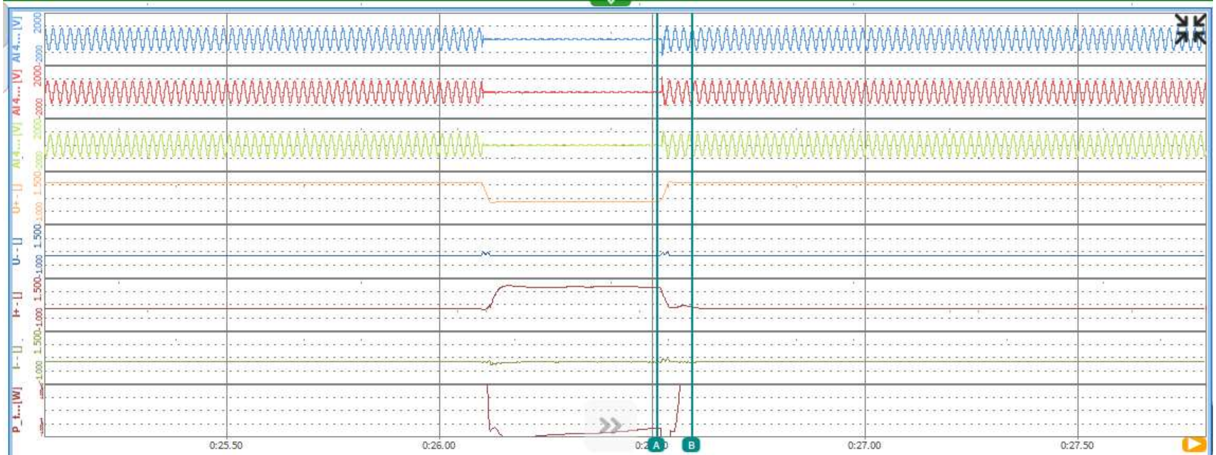
Test 5.1.1

A.2.2(b): Depth of fault phase:5%, three-phase SC fault, △/Yn11, 20% load

	A	B	Delta
Time [s]	0:26.14651	0:26.50560	0.35910
AI 4/U2 [V]	-48.30003	-48.03777	0.262260
AI 4/U3 [V]	37.22477	40.04121	2.816439
AI 4/U4 [V]	11.60407	8.520604	-3.083468
U+ []	0.062595	0.061146	-1.449e-3
U- []	6.694e-3	8.194e-3	1.499e-3
I+ []	1.030429	1.062584	0.032154
I- []	-0.059748	6.302e-3	0.066051
P_fund_SYM+_rc@POWER/0 [W]	-7592.101	8937.549	16529.65

Test 5.1.1

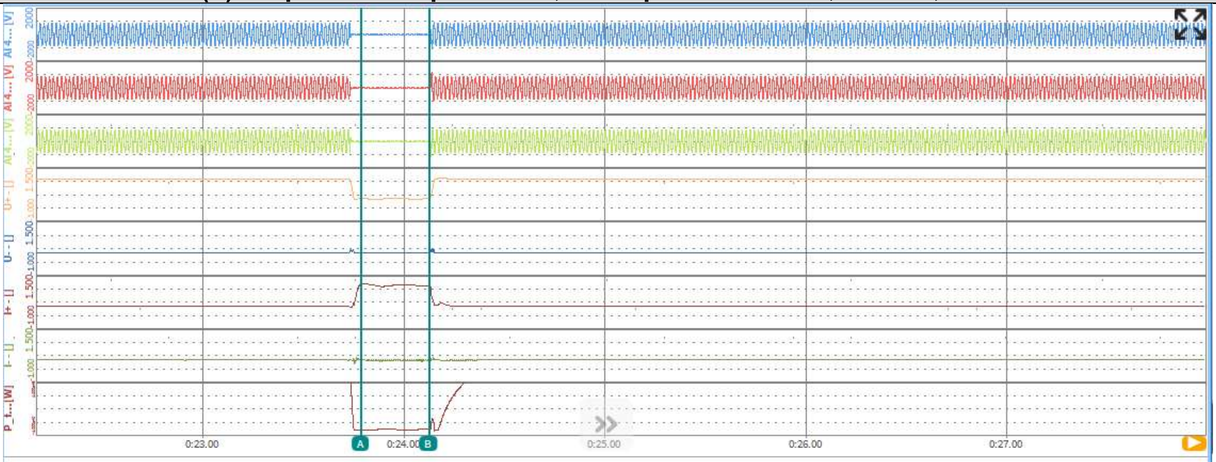
A.2.2(b): Depth of fault phase:5%, three-phase SC fault, △/Yn11, 20% load, restoring time



	A	B	Delta
Time [s]	0:26.51076	0:26.59276	0.08200
AI 4/U2 [V]	-12.89558	760.4640	773.3596
AI 4/U3 [V]	-50.26508	-702.1156	-651.8505
AI 4/U4 [V]	62.84023	-59.03554	-121.8758
U+ []	0.061570	1.000988	0.939418
U- []	9.270e-3	3.509e-3	-5.761e-3
I+ []	1.064443	0.116609	-0.947834
I- []	-0.015911	-8.933e-3	6.978e-3
P_fund_SYM+_rc@POWER/0 [W]	8608.975	313827.2	305218.2

Test 5.1.2

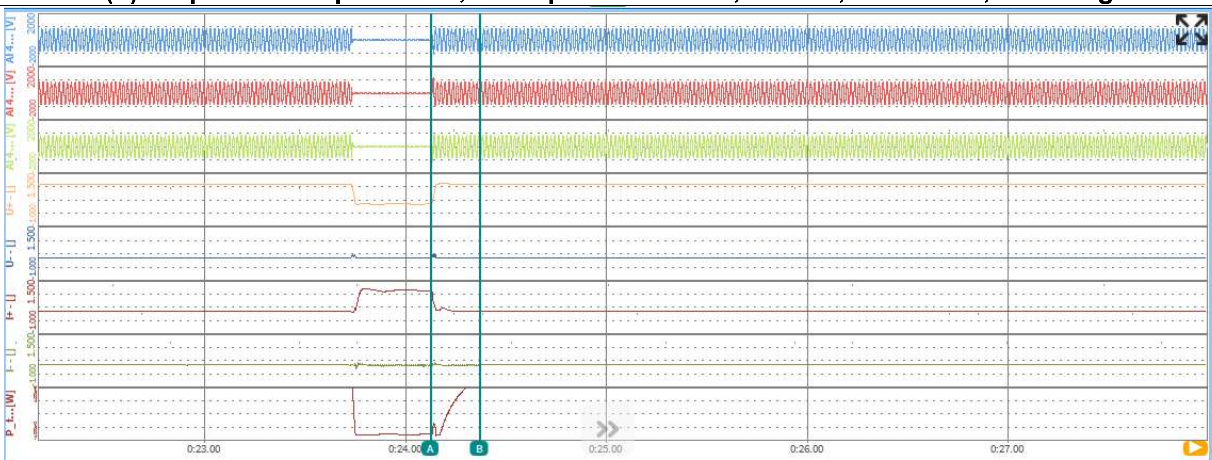
A.2.2(b): Depth of fault phase:5%, three-phase SC fault, △/Yn11, 100% load



	A	B	Delta
Time [s]	0:23.78765	0:24.12591	0.33826
AI 4/U2 [V]	-35.11548	-13.25393	21.86155
AI 4/U3 [V]	27.53115	-27.23313	-54.76427
AI 4/U4 [V]	7.141829	40.65943	33.51760
U+ []	0.053109	0.049666	-3.443e-3
U- []	0.010915	5.885e-3	-5.030e-3
I+ []	1.047319	1.005351	-0.041968
I- []	0.039693	8.899e-3	-0.030794
P_fund_SYM+_rc@POWER/0 [W]	7962.915	26300.92	18338.00

Test 5.1.2

A.2.2(b): Depth of fault phase:5%, three-phase SC fault, △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:24.12633	0:24.37027	0.24394
AI 4/U2 [V]	-4.715920	337.6076	342.3236
AI 4/U3 [V]	-32.24111	-847.5643	-815.3232
AI 4/U4 [V]	37.14657	509.7027	472.5561
U+ []	0.049750	1.012666	0.962916
U- []	6.026e-3	6.085e-3	5.896e-5
I+ []	1.005098	0.012428	-0.992670
I- []	6.429e-3	2.689e-3	-3.740e-3
P_fund_SYM+_rc@POWER/0 [W]	26266.69	1.573e+6	1.546e+6

Test 5.1.3

A.2.3(b): Depth of fault phase:5%, two-phase SC-GND, △/Yn11, 20% load

	A	B	Delta
Time [s]	0:43.020396	0:43.419549	0.399154
AI 4/U1 [V]	-262.7006	-293.0682	-30.36761
AI 4/U2 [V]	-277.8804	-289.0229	-11.14249
AI 4/U3 [V]	540.7300	583.4415	42.71150
U+_pu []	0.390831	0.392648	1.817e-3
U-_pu []	0.301559	0.304493	2.933e-3
I+_pu []	0.692891	0.667469	-0.025422
I-_pu []	-0.327187	-0.325641	1.545e-3
P+_pu []	-0.013343	0.014167	0.027510
P-_pu []	0.010847	1.916e-3	-8.931e-3
Q+_pu []	0.270818	0.262095	-8.723e-3
Q-_pu []	-0.098672	-0.099161	-4.892e-4

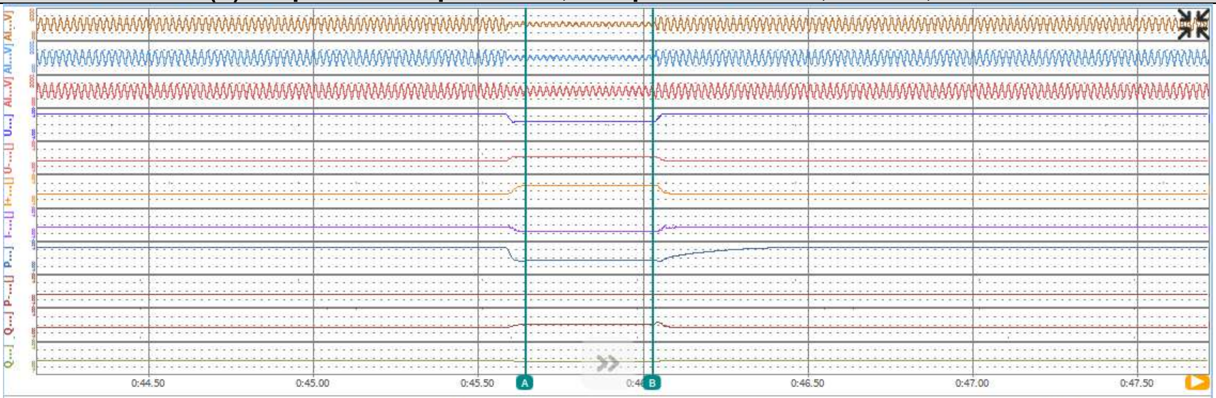
Test 5.1.3

A.2.3(b): Depth of fault phase:5%, two-phase SC-GND, △/Yn11, 20% load, restoring time

	A	B	Delta
Time [s]	0:43.421751	0:43.679645	0.257894
AI 4/U1 [V]	416.1468	-256.1691	-672.3159
AI 4/U2 [V]	-1028.234	-573.8535	454.3803
AI 4/U3 [V]	612.9542	830.2637	217.3095
U+_pu []	0.392572	0.999097	0.606526
U-_pu []	0.304483	3.946e-4	-0.304088
I+_pu []	0.667455	6.488e-4	-0.666806
I-_pu []	-0.325630	-6.873e-4	0.324943
P+_pu []	0.014228	0.184038	0.169811
P-_pu []	2.015e-3	4.281e-8	-2.015e-3
Q+_pu []	0.262038	6.482e-4	-0.261390
Q-_pu []	-0.099154	-2.712e-7	0.099154

Test 5.1.4

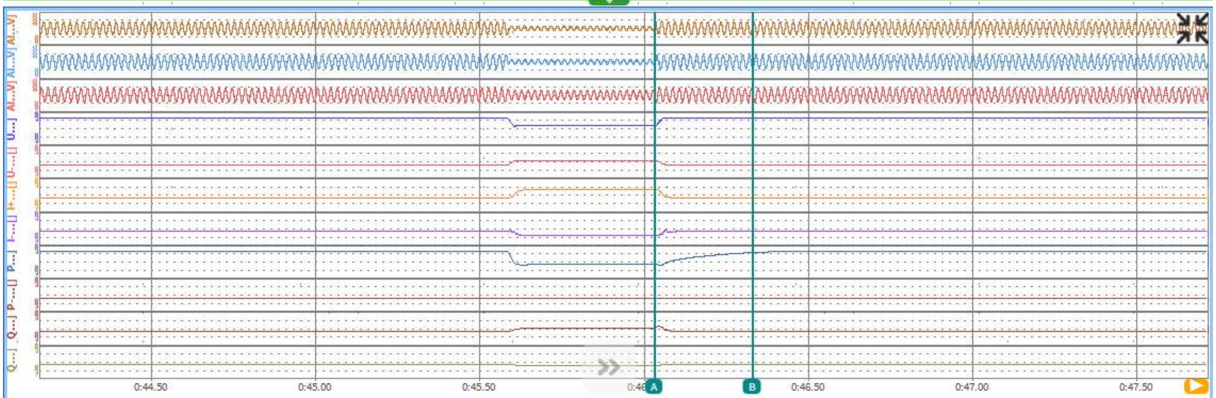
A.2.3(b): Depth of fault phase:5%, two-phase SC-GND, △/Yn11, 100% load



	A	B	Delta
Time [s]	0:45.643233	0:46.028854	0.385620
AI 4/U1 [V]	92.46612	-314.0350	-406.5011
AI 4/U2 [V]	272.9764	-269.5797	-542.5561
AI 4/U3 [V]	-365.9506	583.3838	949.3344
U+_pu []	0.389336	0.393572	4.236e-3
U-_pu []	0.303955	0.304257	3.018e-4
I+_pu []	0.670414	0.668703	-1.711e-3
I-_pu []	-0.333485	-0.322655	0.010830
P+_pu []	-0.050023	0.020509	0.070532
P-_pu []	4.671e-3	-2.691e-3	-7.362e-3
Q+_pu []	0.261031	0.263198	2.167e-3
Q-_pu []	-0.101370	-0.098175	3.195e-3

Test 5.1.4

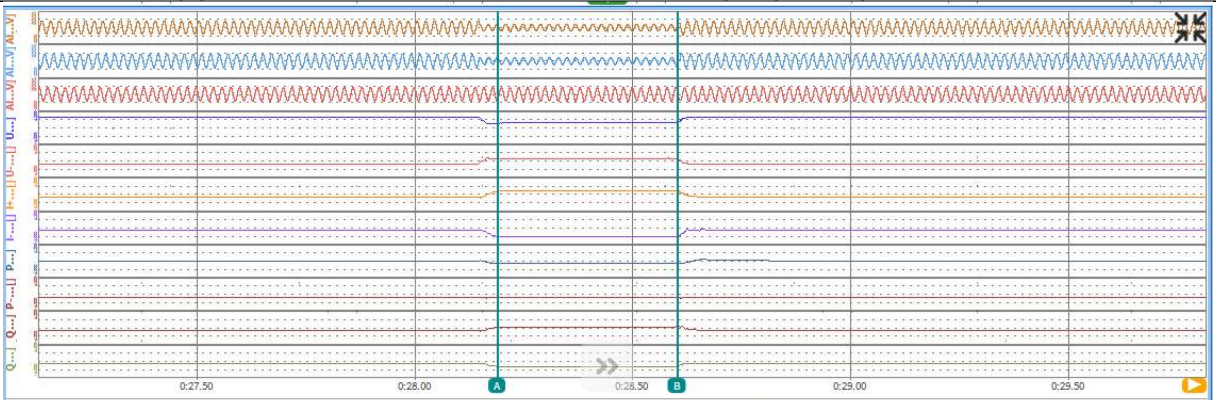
A.2.3(b): Depth of fault phase:5%, two-phase SC-GND, △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:46.032014	0:46.330119	0.298106
AI 4/U1 [V]	-149.9789	-202.0609	-52.08206
AI 4/U2 [V]	-245.5397	-619.4051	-373.8654
AI 4/U3 [V]	396.6401	821.0204	424.3803
U+_pu []	0.394072	1.000172	0.606100
U-_pu []	0.304803	7.356e-3	-0.297448
I+_pu []	0.670460	8.578e-3	-0.661882
I-_pu []	-0.324842	-2.210e-3	0.322632
P+_pu []	0.020265	0.906418	0.886153
P-_pu []	-2.865e-3	1.070e-5	2.876e-3
Q+_pu []	0.264225	8.580e-3	-0.255644
Q-_pu []	-0.099018	-1.626e-5	0.099002

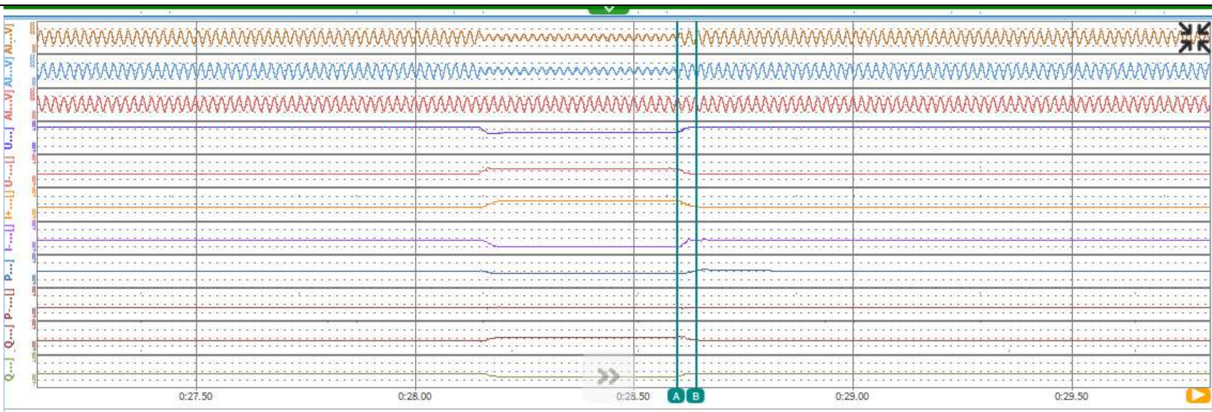
Test 5.1.5

A.2.4(b): Depth of fault phase:5%, two-phase SC(no ground), △/Yn11, 20% load



	A	B	Delta
Time [s]	0:28.19034	0:28.60262	0.41227
AI 4/U1 [V]	347.4655	485.9231	138.4575
AI 4/U2 [V]	429.4627	-840.4875	-1269.950
AI 4/U3 [V]	-776.7466	353.4746	1130.221
U+_pu []	0.539165	0.576791	0.037626
U-_pu []	0.451805	0.419365	-0.032440
I+_pu []	0.442946	0.516555	0.073609
I-_pu []	-0.454784	-0.499745	-0.044960
P+_pu []	2.145e-3	6.561e-3	4.416e-3
P-_pu []	0.030370	-0.024037	-0.054407
Q+_pu []	0.238834	0.297961	0.059126
Q-_pu []	-0.205485	-0.209587	-4.102e-3

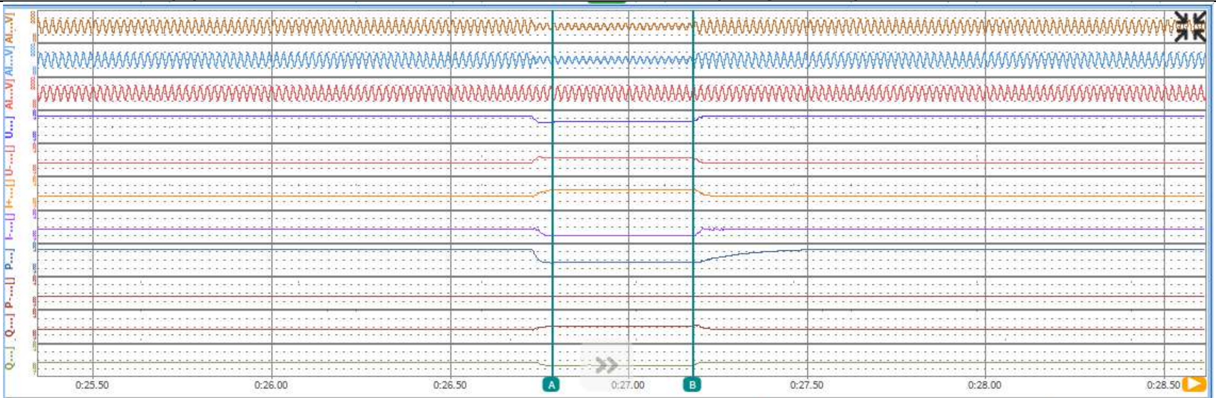
A.2.4(b): Depth of fault phase:5%, two-phase SC(no ground), △/Yn11, 20% load, restoring time



	A	B	Delta
Time [s]	0:28.59774	0:28.64165	0.04391
AI 4/U1 [V]	-437.6619	255.7233	693.3852
AI 4/U2 [V]	-326.1874	-830.1130	-503.9256
AI 4/U3 [V]	764.2060	574.6410	-189.5650
U+_pu []	0.542748	1.009242	0.466493
U-_pu []	0.450890	7.059e-3	-0.443831
I+_pu []	0.501212	0.072335	-0.428877
I-_pu []	-0.491944	-0.040069	0.451874
P+_pu []	0.033646	0.198799	0.165152
P-_pu []	-4.500e-3	7.107e-4	5.211e-3
Q+_pu []	0.272047	0.073008	-0.199040
Q-_pu []	-0.221825	-2.829e-4	0.221542

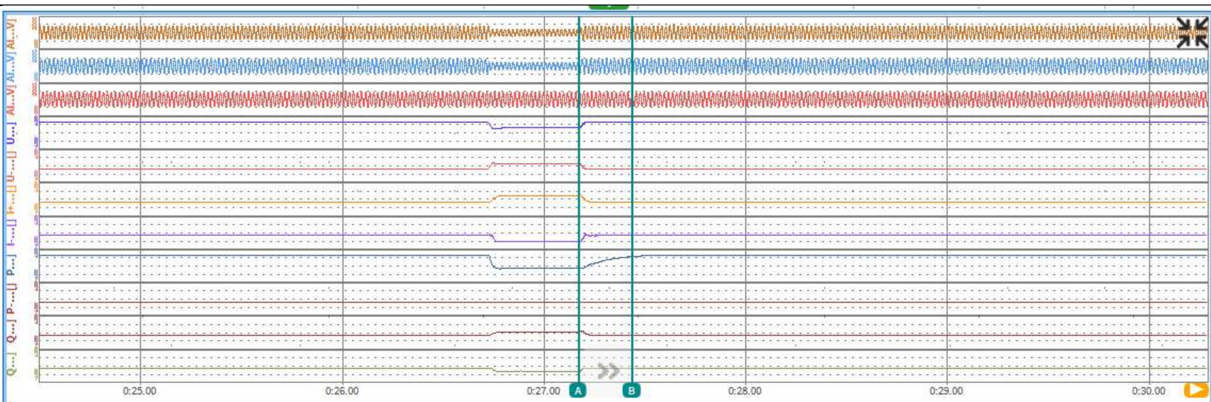
Test 5.1.6

A.2.4(b): Depth of fault phase:5%, two-phase SC(no ground), △/Yn11, 100% load



	A	B	Delta
Time [s]	0:26.78497	0:27.17971	0.39474
AI 4/U1 [V]	-139.1118	-389.9558	-250.8440
AI 4/U2 [V]	-237.1030	-326.0782	-88.97520
AI 4/U3 [V]	376.5564	717.0482	340.4918
U+_pu []	0.539215	0.543548	4.333e-3
U-_pu []	0.447209	0.451540	4.331e-3
I+_pu []	0.461165	0.504712	0.043547
I-_pu []	-0.535486	-0.479181	0.056305
P+_pu []	-0.042037	0.022315	0.064352
P-_pu []	0.023466	1.190e-3	-0.022276
Q+_pu []	0.248681	0.274350	0.025669
Q-_pu []	-0.239488	-0.216382	0.023106

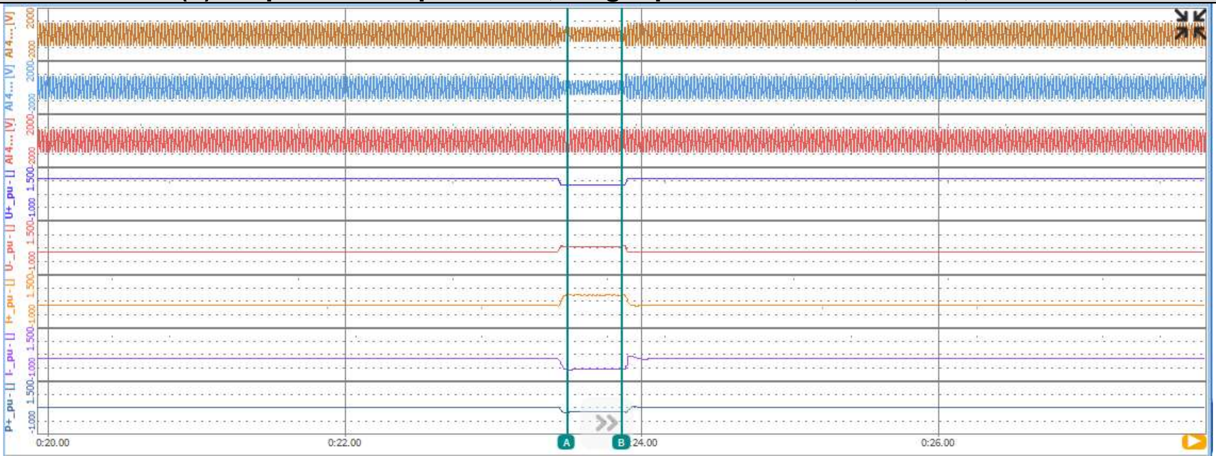
A.2.4(b): Depth of fault phase:5%, two-phase SC(no ground), △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:27.17163	0:27.43865	0.26702
AI 4/U1 [V]	414.9840	-841.6291	-1256.613
AI 4/U2 [V]	433.4240	262.5141	-170.9099
AI 4/U3 [V]	-847.8718	578.6660	1426.538
U+_pu []	0.543589	1.004300	0.460711
U-_pu []	0.451641	4.067e-3	-0.447574
I+_pu []	0.506377	9.648e-3	-0.496728
I-_pu []	-0.479067	1.948e-4	0.479262
P+_pu []	0.020723	0.904657	0.883934
P-_pu []	2.376e-3	-1.627e-5	-2.392e-3
Q+_pu []	0.275276	9.690e-3	-0.265586
Q-_pu []	-0.216378	7.925e-7	0.216379

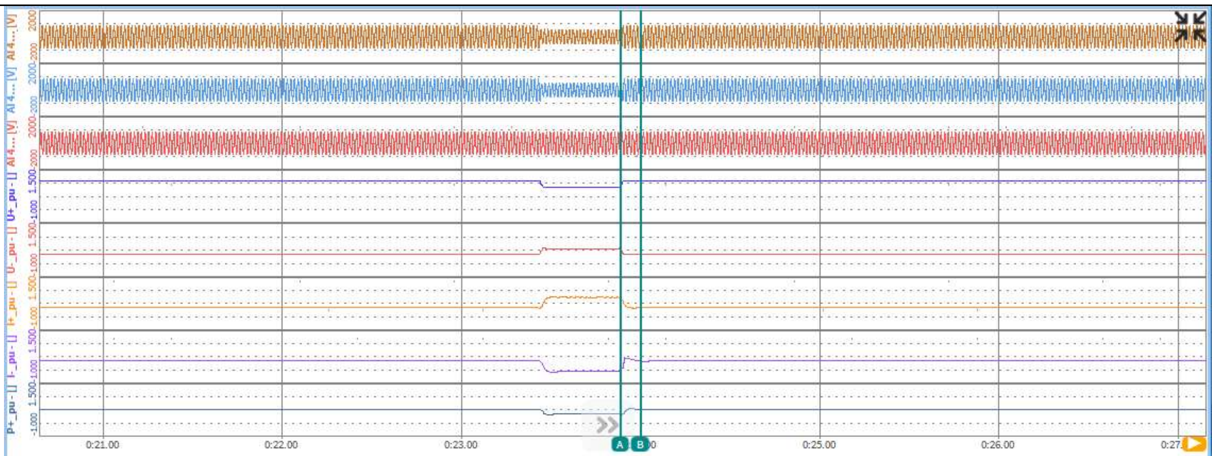
Test 5.1.7

A.2.5(b): Depth of fault phase:5%, single-phase SC-GND, △/Yn11, 20% load



	A	B	Delta
Time [s]	0:23.49578	0:23.86777	0.37199
AI 4/U1 [V]	-308.6162	505.6074	814.2236
AI 4/U2 [V]	279.8777	10.32090	-269.5568
AI 4/U3 [V]	27.51613	-516.6087	-544.1249
U+_pu []	0.693457	0.696494	3.037e-3
U-_pu []	0.290152	0.290829	6.771e-4
I+_pu []	0.494858	0.501676	6.817e-3
I-_pu []	-0.510600	-0.479856	0.030744
P+_pu []	-0.034532	0.023788	0.058320

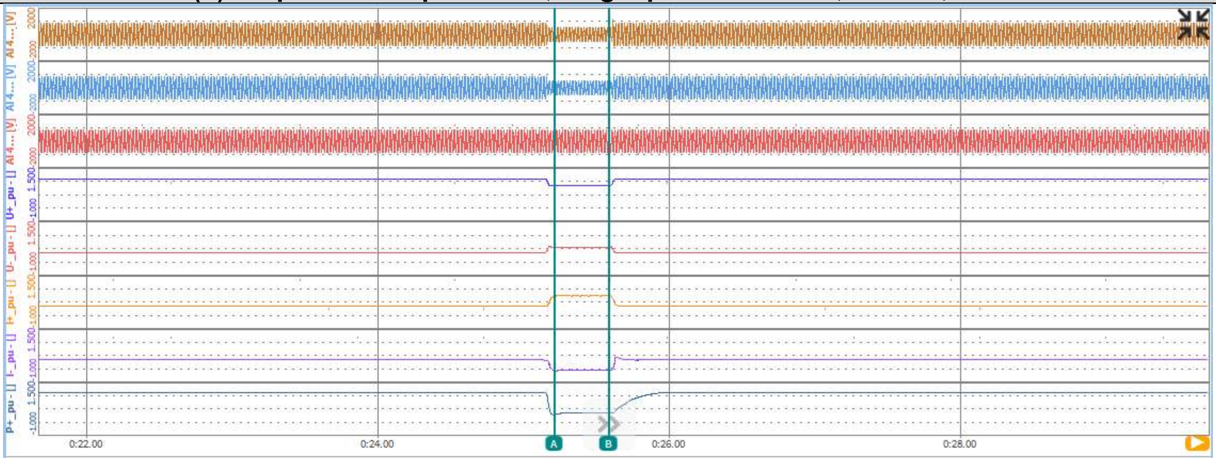
A.2.5(b): Depth of fault phase:5%, single-phase SC-GND, △/Yn11, 20% load, restoring time



	A	B	Delta
Time [s]	0:23.89148	0:24.00195	0.11047
AI 4/U1 [V]	344.9037	-91.20370	-436.1074
AI 4/U2 [V]	470.7642	-678.7775	-1149.542
AI 4/U3 [V]	-815.3220	769.3561	1584.678
U+_pu []	0.683901	0.995761	0.311860
U-_pu []	0.271617	2.458e-3	-0.269159
I+_pu []	0.494408	-4.025e-3	-0.498432
I-_pu []	-0.466171	4.440e-3	0.470611
P+_pu []	0.026334	0.220616	0.194282

Test 5.1.8

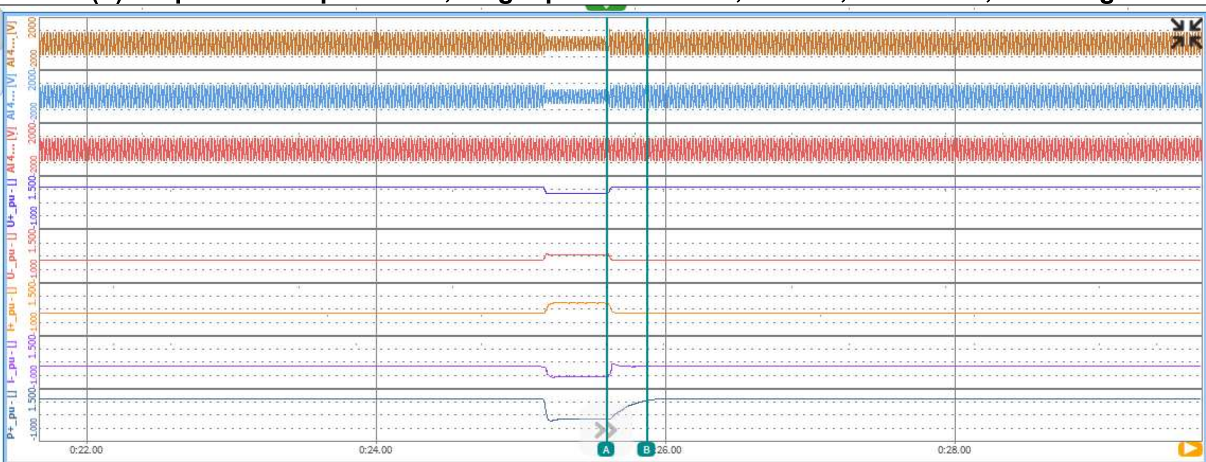
A.2.5(b): Depth of fault phase:5%, single-phase SC-GND, △/Yn11, 100% load



	A	B	Delta
Time [s]	0:25.21563	0:25.58709	0.37146
AI 4/U1 [V]	430.5611	-317.0514	-747.6125
AI 4/U2 [V]	405.6173	-484.9055	-890.5228
AI 4/U3 [V]	-835.8369	800.7117	1636.549
U+_pu []	0.693193	0.698783	5.589e-3
U-_pu []	0.289756	0.291746	1.989e-3
I+_pu []	0.482403	0.508985	0.026581
I-_pu []	-0.502474	-0.483845	0.018630
P+_pu []	-0.062316	0.033025	0.095341

Test 5.1.8

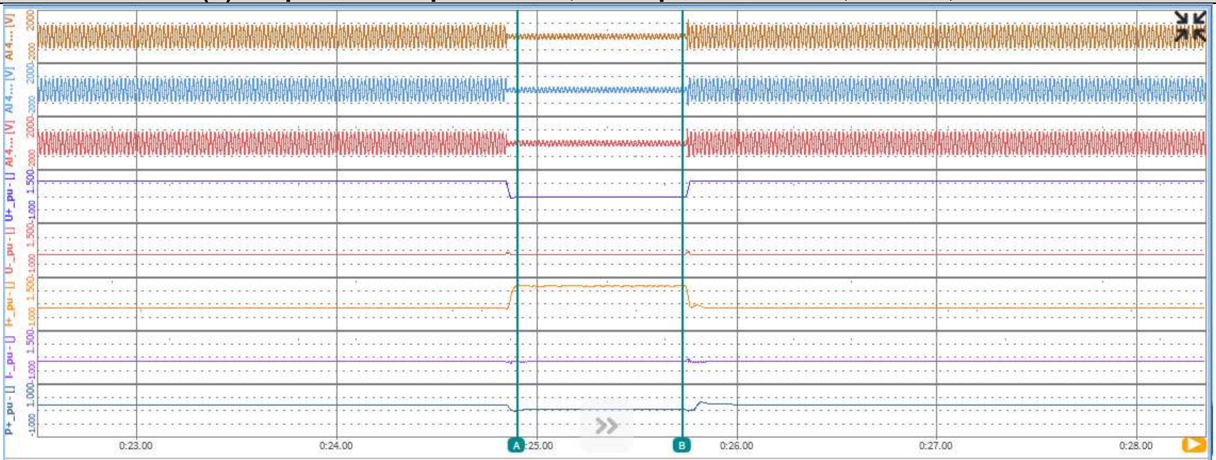
A.2.5(b): Depth of fault phase:5%, single-phase SC-GND, △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:25.59285	0:25.87070	0.27785
AI 4/U1 [V]	478.9629	717.4757	238.5128
AI 4/U2 [V]	-5.009175	-748.2775	-743.2683
AI 4/U3 [V]	-474.4242	29.02746	503.4516
U+_pu []	0.697220	1.002219	0.305000
U-_pu []	0.289849	3.218e-3	-0.286631
I+_pu []	0.505083	8.797e-3	-0.496286
I-_pu []	-0.477873	3.289e-3	0.481162
P+_pu []	0.025127	0.901994	0.876867

Test 5.2.1

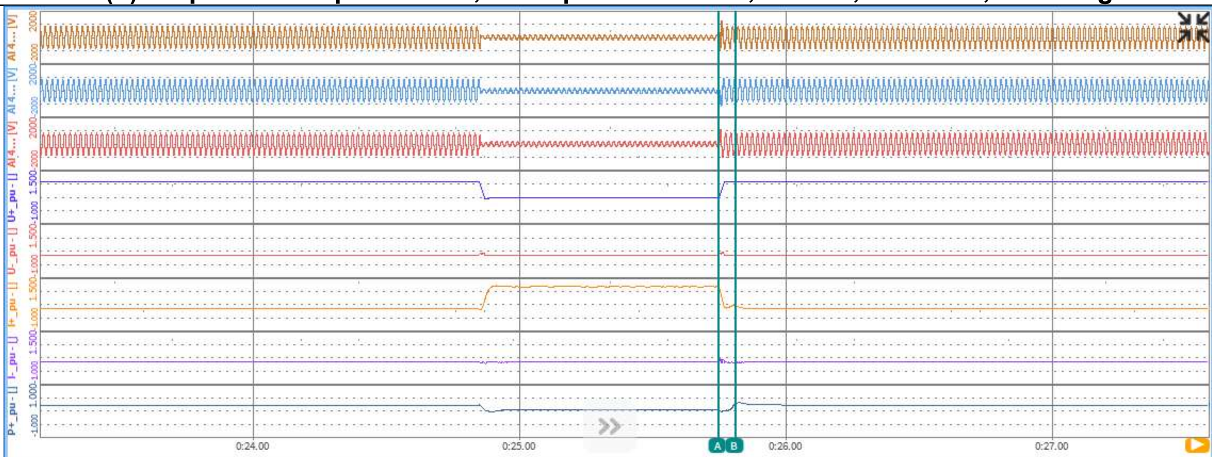
A.2.2(b): Depth of fault phase:20%, three-phase SC fault, △/Yn11, 20% load



	A	B	Delta
Time [s]	0:24.90157	0:25.72926	0.82768
AI 4/U1 [V]	157.3579	-168.6666	-326.0246
AI 4/U2 [V]	2.268791	108.9006	106.6318
AI 4/U3 [V]	-161.0000	60.24289	221.2429
U+_pu []	0.211482	0.218794	7.312e-3
U-_pu []	3.430e-3	7.675e-3	4.245e-3
I+_pu []	1.077739	1.068127	-9.612e-3
I-_pu []	0.035290	1.211e-3	-0.034079
P+_pu []	-0.046420	7.759e-3	0.054179

Test 5.2.1

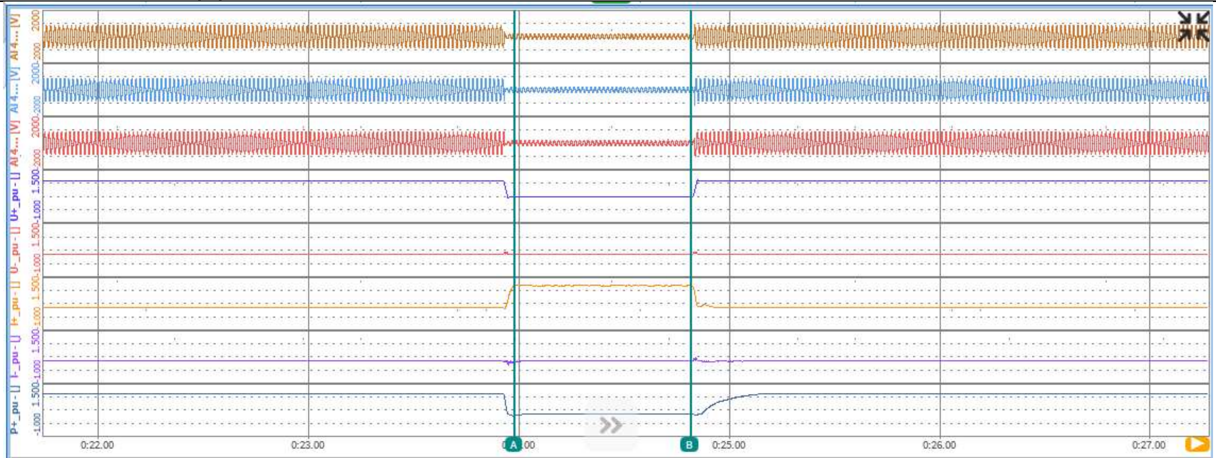
A.2.2(b): Depth of fault phase:20%, three-phase SC fault, △/Yn11, 20% load, restoring time



	A	B	Delta
Time [s]	0:25.74364	0:25.80910	0.06545
AI 4/U1 [V]	67.73019	-857.2226	-924.9528
AI 4/U2 [V]	119.8833	538.3404	418.4571
AI 4/U3 [V]	-188.0601	317.7376	505.7977
U+_pu []	0.218779	1.012322	0.793543
U-_pu []	7.381e-3	5.844e-3	-1.538e-3
I+_pu []	1.067050	0.167002	-0.900048
I-_pu []	2.229e-3	-0.012952	-0.015180
P+_pu []	7.816e-3	0.207768	0.199952

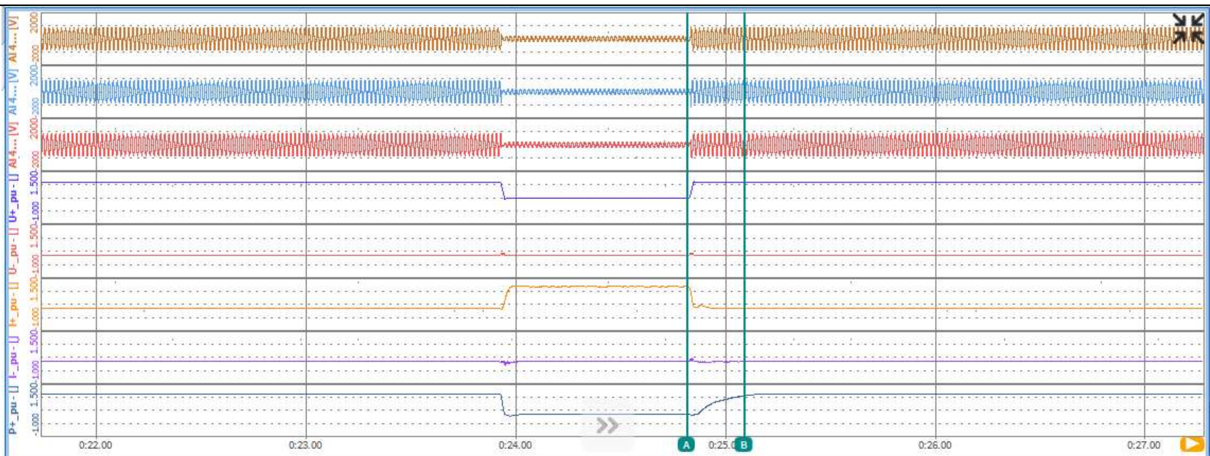
Test 5.2.2

A.2.2(b): Depth of fault phase:20%, three-phase SC fault, △/Yn11, 100% load



	A	B	Delta
Time [s]	0:23.97942	0:24.81412	0.83470
AI 4/U1 [V]	119.7026	129.6847	9.982110
AI 4/U2 [V]	72.54863	-181.7479	-254.2966
AI 4/U3 [V]	-193.0080	51.18370	244.1917
U+_pu []	0.231526	0.220910	-0.010617
U-_pu []	5.629e-3	7.410e-3	1.781e-3
I+_pu []	1.032111	1.067180	0.035070
I-_pu []	-0.019422	2.277e-3	0.021699
P+_pu []	-0.057099	7.796e-3	0.064895

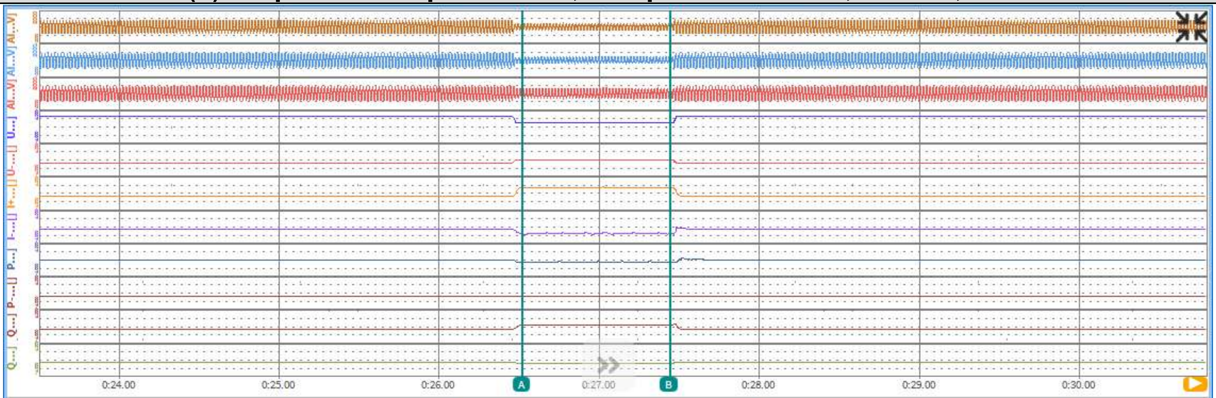
A.2.2(b): Depth of fault phase:20%, three-phase SC fault, △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:24.81662	0:25.08932	0.27270
AI 4/U1 [V]	189.4357	-446.0604	-635.4962
AI 4/U2 [V]	-95.99472	-407.9478	-311.9531
AI 4/U3 [V]	-93.86182	854.3368	948.1986
U+_pu []	0.220549	0.999199	0.778650
U-_pu []	6.459e-3	3.362e-3	-3.098e-3
I+_pu []	1.066713	8.693e-3	-1.058020
I-_pu []	8.248e-3	-3.498e-3	-0.011746
P+_pu []	7.545e-3	0.903290	0.895745

Test 5.2.3

A.2.3(b): Depth of fault phase:20%, two-phase SC-GND, △/Yn11, 20% load



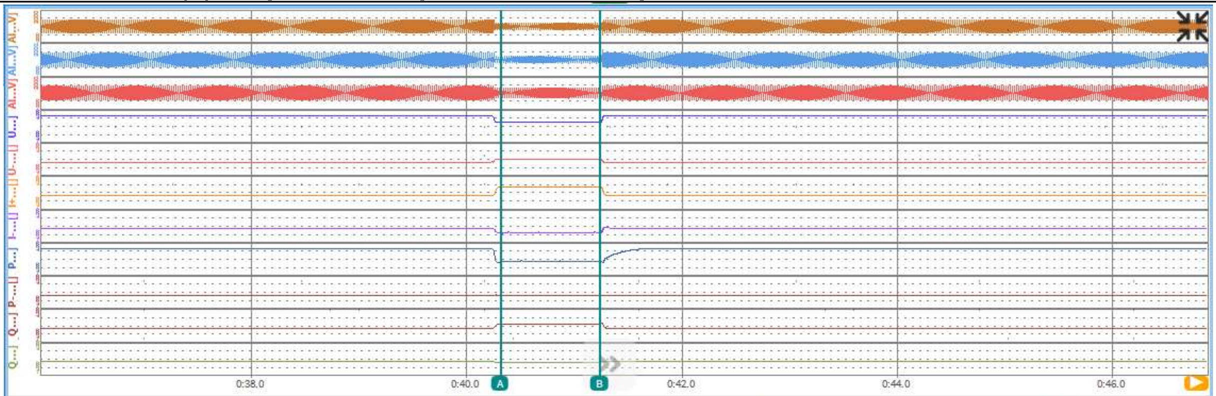
	A	B	Delta
Time [s]	0:26.52026	0:27.44011	0.91985
AI 4/U1 [V]	144.0120	148.1068	4.094839
AI 4/U2 [V]	343.1895	355.2029	12.01344
AI 4/U3 [V]	-487.2728	-503.6369	-16.36410
U+_pu []	0.487399	0.488583	1.184e-3
U-_pu []	0.247862	0.248222	3.598e-4
I+_pu []	0.688643	0.652759	-0.035883
I-_pu []	-0.343021	-0.369712	-0.026691
P+_pu []	-0.040295	0.034530	0.074825
P-_pu []	0.016762	2.231e-3	-0.014531
Q+_pu []	0.335662	0.318945	-0.016718
Q-_pu []	-0.085027	-0.091776	-6.749e-3

A.2.3(b): Depth of fault phase:20%, two-phase SC-GND, △/Yn11, 20% load, restoring time

	A	B	Delta
Time [s]	0:27.46409	0:27.57569	0.11160
AI 4/U1 [V]	-307.4973	813.8063	1121.304
AI 4/U2 [V]	146.6236	-185.2036	-331.8272
AI 4/U3 [V]	160.8846	-628.5353	-789.4199
U+_pu []	0.495386	0.999880	0.504493
U-_pu []	0.262062	1.607e-3	-0.260455
I+_pu []	0.662074	-6.473e-3	-0.668547
I-_pu []	-0.359091	0.013025	0.372116
P+_pu []	0.015308	0.208474	0.193166
P-_pu []	-1.501e-3	2.615e-5	1.527e-3
Q+_pu []	0.328001	-6.472e-3	-0.334473
Q-_pu []	-0.094110	2.093e-5	0.094130

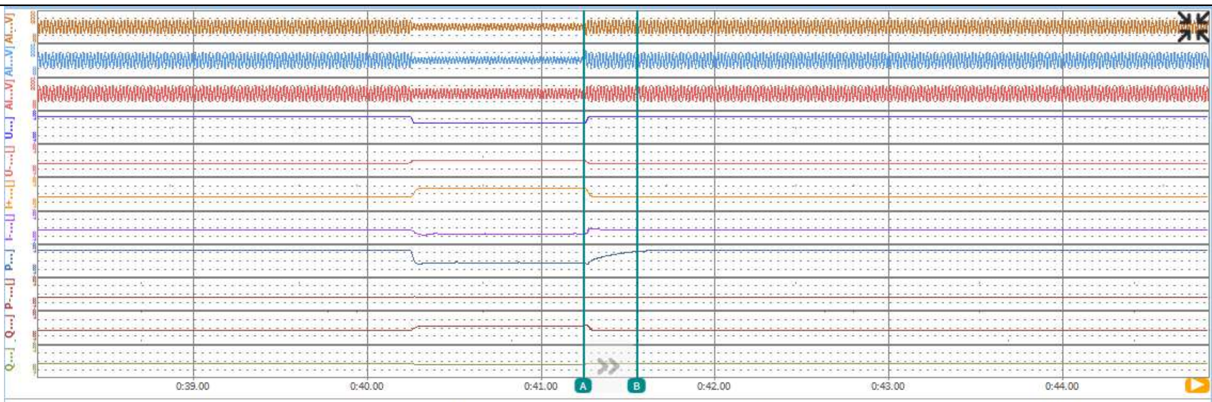
Test 5.2.4

A.2.3(b): Depth of fault phase:20%, two-phase SC-GND, △/Yn11, 100% load



	A	B	Delta
Time [s]	0:40.31675	0:41.23982	0.92307
AI 4/U1 [V]	288.0294	-34.55472	-322.5842
AI 4/U2 [V]	324.4591	287.1289	-37.33015
AI 4/U3 [V]	-612.5977	-252.2366	360.3611
U+_pu []	0.486371	0.491168	4.796e-3
U-_pu []	0.247102	0.251364	4.262e-3
I+_pu []	0.664980	0.682520	0.017541
I-_pu []	-0.369943	-0.330341	0.039603
P+_pu []	-0.052499	0.025326	0.077825
P-_pu []	0.017085	-4.349e-3	-0.021434
Q+_pu []	0.323445	0.335251	0.011805
Q-_pu []	-0.091419	-0.083040	8.378e-3

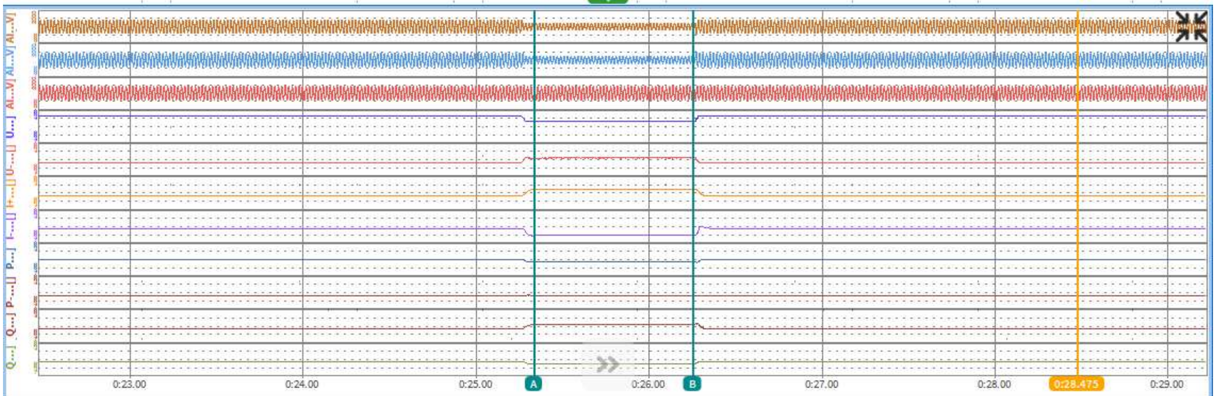
A.2.3(b): Depth of fault phase:20%, two-phase SC-GND, △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:41.24771	0:41.55376	0.30604
AI 4/U1 [V]	-199.2366	802.7425	1001.979
AI 4/U2 [V]	-351.6953	-155.3786	196.3167
AI 4/U3 [V]	551.8451	-646.9477	-1198.793
U+_pu []	0.491172	1.000412	0.509240
U-_pu []	0.251829	4.844e-3	-0.246984
I+_pu []	0.683748	0.010088	-0.673661
I-_pu []	-0.324758	-5.710e-4	0.324187
P+_pu []	0.028827	0.904869	0.876042
P-_pu []	-5.368e-3	-1.484e-5	5.353e-3
Q+_pu []	0.335857	0.010092	-0.325764
Q-_pu []	-0.081788	-2.766e-6	0.081785

Test 5.2.5

A.2.4(b): Depth of fault phase:20%, two-phase SC(no ground), △/Yn11, 20% load



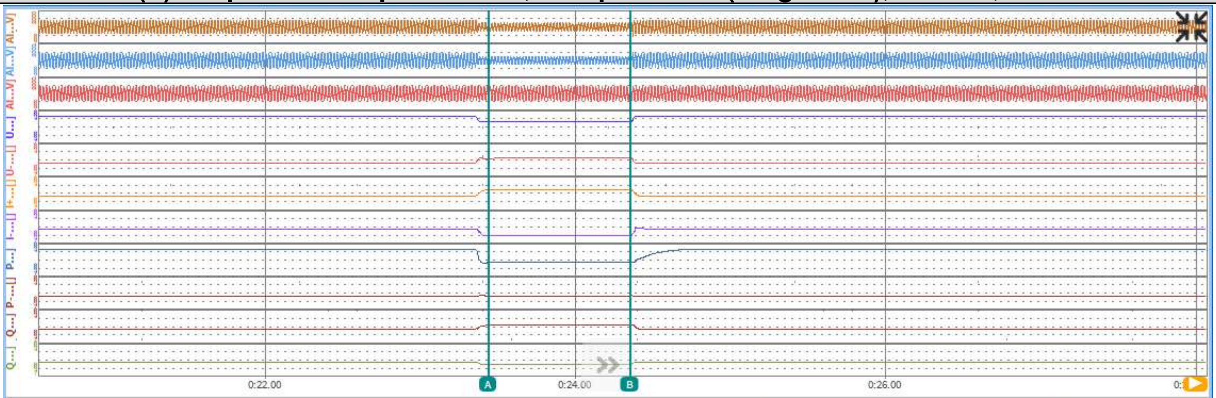
	A	B	Delta
Time [s]	0:25.33708	0:26.25399	0.91690
AI 4/U1 [V]	-202.9562	225.7881	428.7443
AI 4/U2 [V]	162.6654	435.1819	272.5165
AI 4/U3 [V]	40.58147	-660.8386	-701.4201
U+_pu []	0.613596	0.616589	2.993e-3
U-_pu []	0.371559	0.375953	4.394e-3
I+_pu []	0.498592	0.495519	-3.073e-3
I-_pu []	-0.544165	-0.493997	0.050168
P+_pu []	-0.011011	0.032629	0.043640
P-_pu []	0.023461	-1.224e-3	-0.024685
Q+_pu []	0.305951	0.305548	-4.024e-4
Q-_pu []	-0.202201	-0.185730	0.016471

A.2.4(b): Depth of fault phase:20%, two-phase SC(no ground), △/Yn11, 20% load, restoring time

	A	B	Delta
Time [s]	0:26.25399	0:26.39599	0.14200
AI 4/U1 [V]	225.7881	-603.4902	-829.2783
AI 4/U2 [V]	435.1819	822.0764	386.8945
AI 4/U3 [V]	-660.8386	-218.8060	442.0326
U+_pu []	0.616589	0.996041	0.379453
U-_pu []	0.375953	2.330e-3	-0.373623
I+_pu []	0.495519	-4.234e-4	-0.495942
I-_pu []	-0.493997	-7.305e-3	0.486692
P+_pu []	0.032629	0.181686	0.149058
P-_pu []	-1.224e-3	3.795e-5	1.262e-3
Q+_pu []	0.305548	-4.217e-4	-0.305970
Q-_pu []	-0.185730	-1.703e-5	0.185713

Test 5.2.6

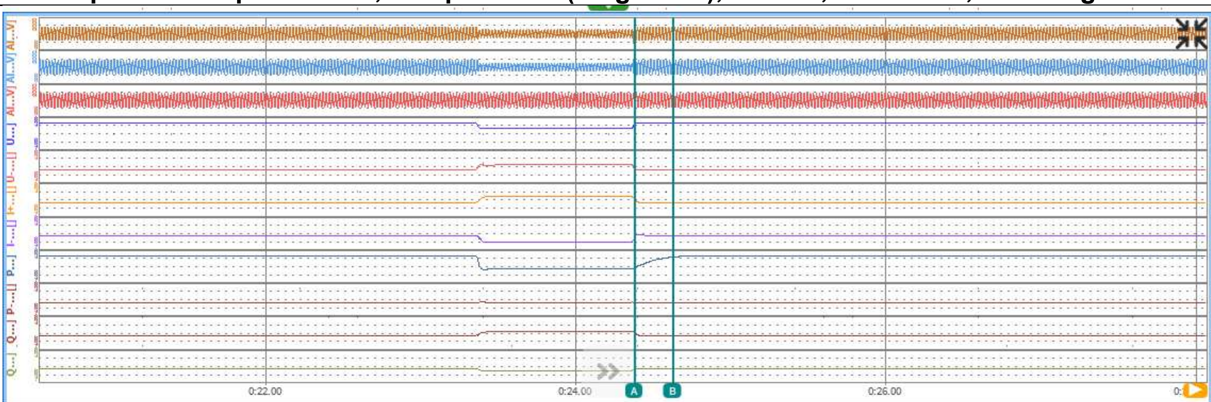
A.2.4(b): Depth of fault phase:20%, two-phase SC(no ground), △/Yn11, 100% load



	A	B	Delta
Time [s]	0:23.43933	0:24.35194	0.91261
AI 4/U1 [V]	438.2453	-418.4580	-856.7033
AI 4/U2 [V]	137.0921	-427.4595	-564.5516
AI 4/U3 [V]	-575.1410	844.3966	1419.538
U+_pu []	0.611510	0.615044	3.534e-3
U-_pu []	0.370192	0.376712	6.520e-3
I+_pu []	0.496985	0.502780	5.795e-3
I-_pu []	-0.519875	-0.470394	0.049482
P+_pu []	-0.038855	0.022379	0.061233
P-_pu []	0.012657	1.286e-3	-0.011371
Q+_pu []	0.303928	0.309249	5.321e-3
Q-_pu []	-0.192465	-0.177213	0.015252

A.2.4(b):

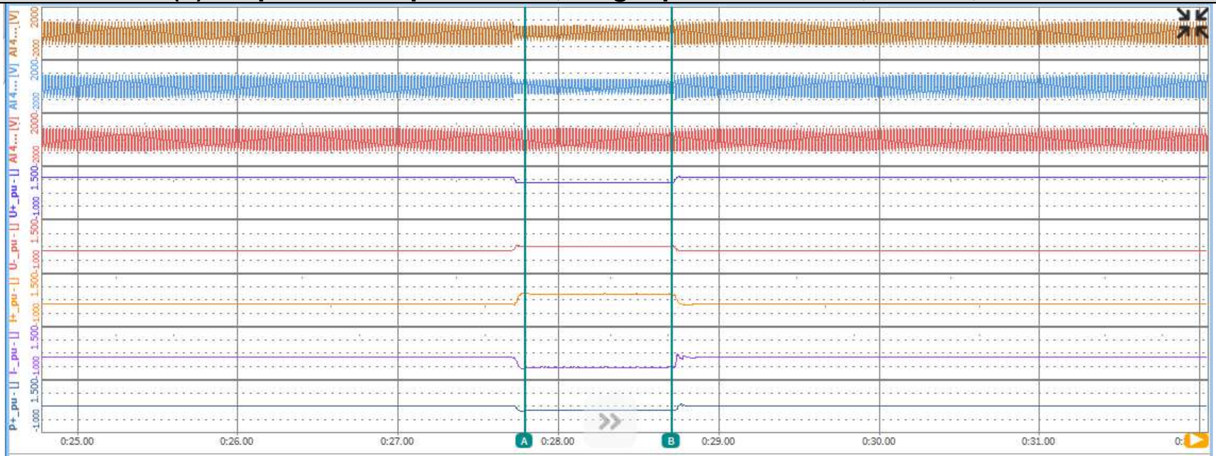
Depth of fault phase:20%, two-phase SC(no ground), △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:24.37939	0:24.62641	0.24702
AI 4/U1 [V]	833.3228	-677.0058	-1510.329
AI 4/U2 [V]	-259.3875	781.7111	1041.099
AI 4/U3 [V]	-573.0636	-104.4874	468.5762
U+_pu []	0.867667	1.002151	0.134484
U-_pu []	0.127136	3.734e-3	-0.123402
I+_pu []	0.386780	0.010221	-0.376559
I-_pu []	-0.327724	4.388e-3	0.332112
P+_pu []	5.096e-3	0.909078	0.903981
P-_pu []	0.014347	9.558e-7	-0.014346
Q+_pu []	0.335615	0.010244	-0.325371
Q-_pu []	-0.041668	1.638e-5	0.041684

Test 5.2.7

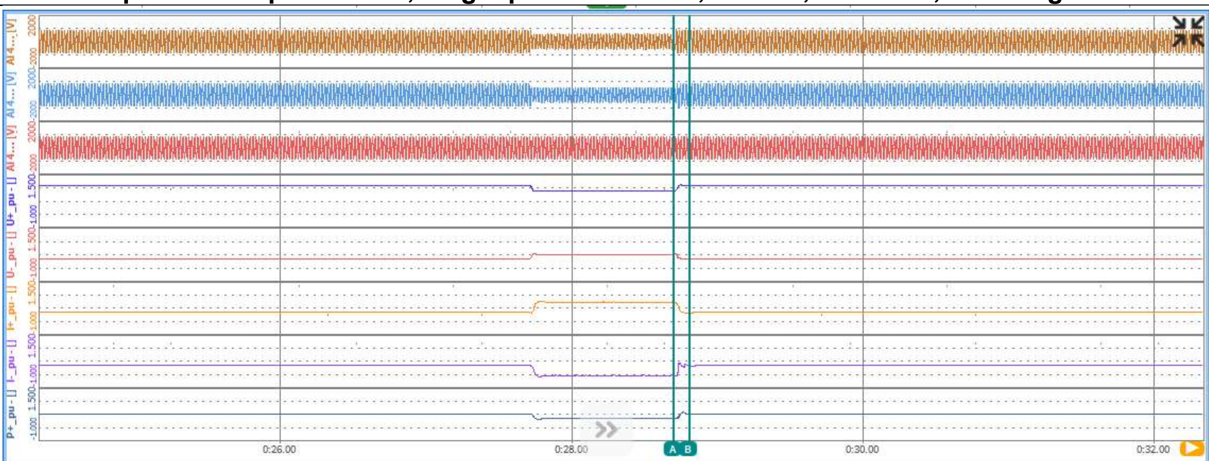
A.2.5(b): Depth of fault phase:20%, single-phase SC-GND, △/Yn11, 20% load



	A	B	Delta
Time [s]	0:27.79171	0:28.70623	0.91452
AI 4/U1 [V]	-409.6072	412.7250	822.3322
AI 4/U2 [V]	283.5386	434.6113	151.0727
AI 4/U3 [V]	126.0445	-847.1311	-973.1756
U+_pu []	0.742196	0.745752	3.556e-3
U-_pu []	0.241489	0.244767	3.278e-3
I+_pu []	0.514674	0.495644	-0.019031
I-_pu []	-0.521443	-0.453524	0.067919
P+_pu []	-0.015031	0.018593	0.033624

A.2.5(b):

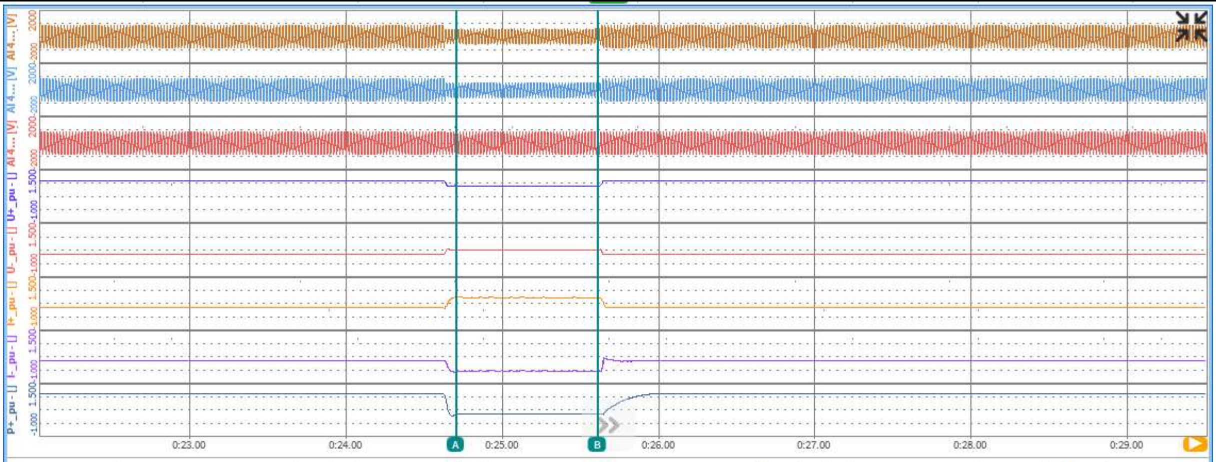
Depth of fault phase:20%, single-phase SC-GND, △/Yn11, 20% load, restoring time



	A	B	Delta
Time [s]	0:28.69780	0:28.80624	0.10844
AI 4/U1 [V]	-194.0322	458.8187	652.8509
AI 4/U2 [V]	-533.9589	394.8121	928.7711
AI 4/U3 [V]	728.5438	-854.3416	-1582.885
U+_pu []	0.746306	0.998914	0.252608
U-_pu []	0.246331	2.013e-3	-0.244318
I+_pu []	0.504313	-0.010398	-0.514710
I-_pu []	-0.459752	0.034329	0.494081
P+_pu []	0.031439	0.229511	0.198072

Test 5.2.8

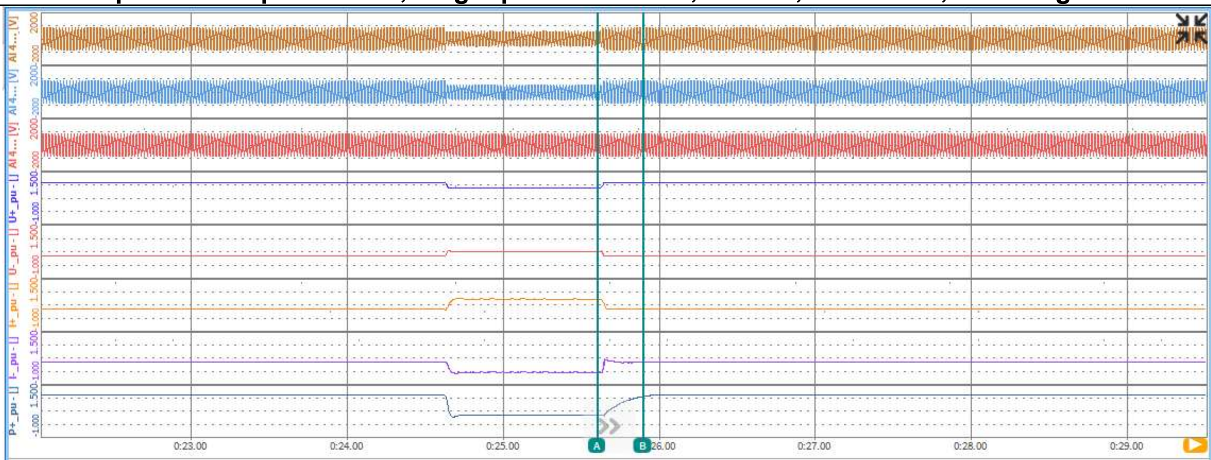
A.2.5(b): Depth of fault phase:20%, single-phase SC-GND, △/Yn11, 100% load



	A	B	Delta
Time [s]	0:24.705334	0:25.610852	0.905518
AI 4/U1 [V]	102.8051	-555.3358	-658.1409
AI 4/U2 [V]	520.9561	-83.84252	-604.7986
AI 4/U3 [V]	-623.2720	638.2125	1261.484
U+_pu []	0.742278	0.746886	4.608e-3
U-_pu []	0.241422	0.244710	3.288e-3
I+_pu []	0.516188	0.499328	-0.016860
I-_pu []	-0.520028	-0.468764	0.051264
P+_pu []	-0.040915	0.028304	0.069219

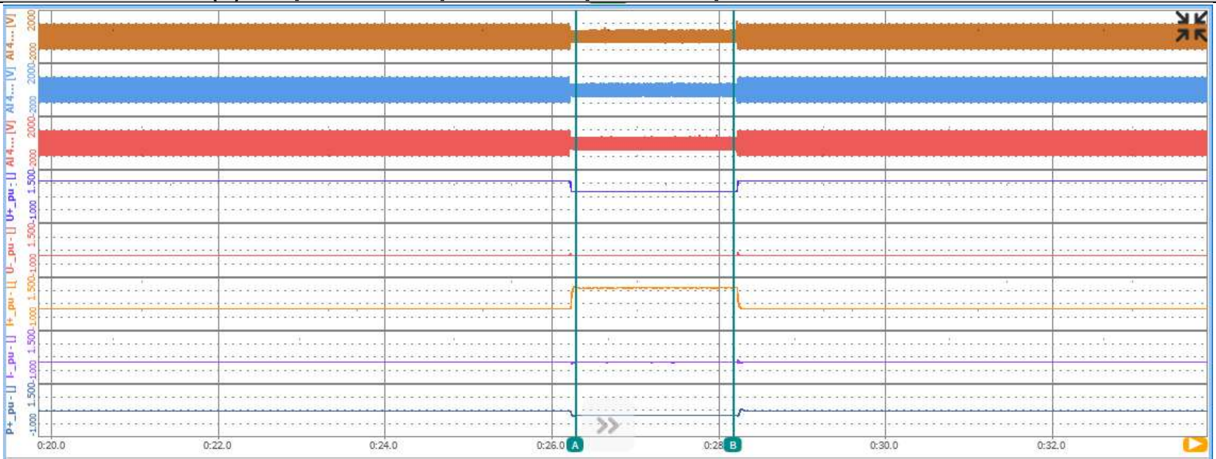
A.2.5(b):

Depth of fault phase:20%, single-phase SC-GND, △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:25.604044	0:25.896805	0.292761
AI 4/U1 [V]	271.8110	556.2656	284.4546
AI 4/U2 [V]	535.4872	-836.7687	-1372.256
AI 4/U3 [V]	-807.4313	280.8342	1088.265
U+_pu []	0.746857	1.003360	0.256502
U-_pu []	0.244632	3.175e-3	-0.241457
I+_pu []	0.499313	9.973e-3	-0.489339
I-_pu []	-0.467788	1.881e-3	0.469669
P+_pu []	0.027761	0.906365	0.878604

Test 5.2.1
A.2.2(b): Depth of fault phase:0.50 p.u, three-phase SC, △/Yn11, 20% load



	A	B	Delta
Time [s]	0:26.28693	0:28.17452	1.88759
AI 4/U1 [V]	-300.7021	465.4627	766.1648
AI 4/U2 [V]	-170.4724	-159.6174	10.85496
AI 4/U3 [V]	470.9642	-304.5209	-775.4851
U+_pu []	0.513251	0.508474	-4.777e-3
U-_pu []	7.156e-3	5.503e-3	-1.654e-3
I+_pu []	1.034288	0.992668	-0.041620
I-_pu []	-9.532e-5	4.621e-3	4.717e-3
P+_pu []	2.745e-3	0.019164	0.016419

Test 5.2.1
A.2.2(b): Depth of fault phase:0.50 p.u, three-phase SC, △/Yn11, 20% load, restoring time

	A	B	Delta
Time [s]	0:28.18727	0:28.32731	0.14004
AI 4/U1 [V]	-219.4951	-445.6847	-226.1896
AI 4/U2 [V]	-257.5278	-499.0521	-241.5242
AI 4/U3 [V]	475.4231	944.8653	469.4422
U+_pu []	0.508951	1.007336	0.498384
U-_pu []	5.400e-3	2.052e-3	-3.348e-3
I+_pu []	1.009325	-6.148e-3	-1.015474
I-_pu []	-6.830e-3	1.029e-3	7.860e-3
P+_pu []	0.026782	0.212376	0.185594

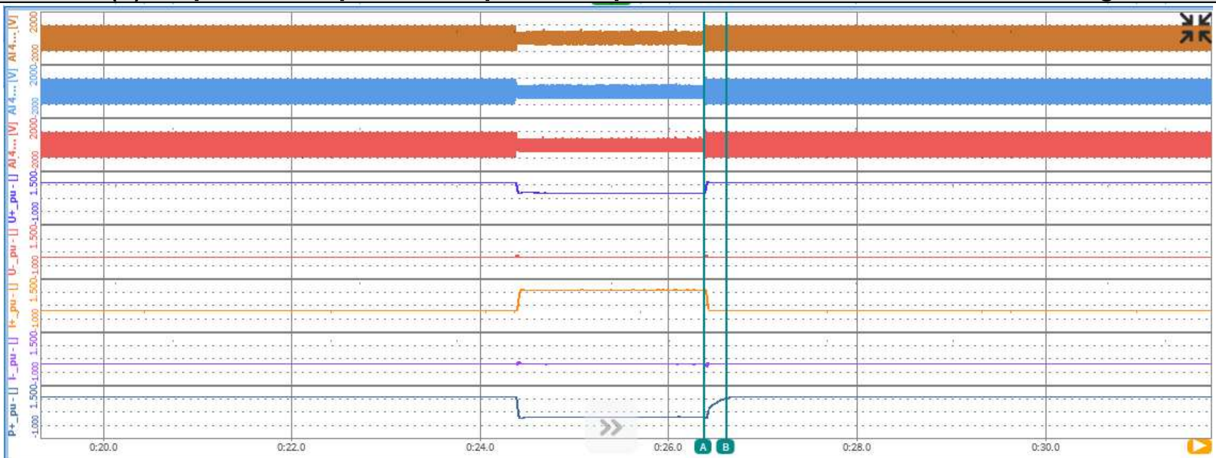
Test 5.2.2

A.2.2(b): Depth of fault phase:0.50 p.u, three-phase SC, △/Yn11, 100% load

	A	B	Delta
Time [s]	0:24.46091	0:26.37348	1.91258
AI 4/U1 [V]	-483.1295	359.2448	842.3744
AI 4/U2 [V]	265.4011	98.53030	-166.8708
AI 4/U3 [V]	219.1732	-458.6029	-677.7761
U+_pu []	0.525517	0.518626	-6.891e-3
U-_pu []	7.326e-3	5.741e-3	-1.585e-3
I+_pu []	1.001757	0.996102	-5.655e-3
I-_pu []	0.013347	-6.481e-3	-0.019828
P+_pu []	-0.014156	0.025517	0.039673

Test 5.2.2

A.2.2(b): Depth of fault phase:0.50 p.u, three-phase SC, △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:26.37348	0:26.61114	0.23766
AI 4/U1 [V]	359.2448	937.0437	577.7989
AI 4/U2 [V]	98.53030	-417.0664	-515.5967
AI 4/U3 [V]	-458.6029	-519.8584	-61.25546
U+_pu []	0.518626	1.005994	0.487369
U-_pu []	5.741e-3	6.585e-3	8.445e-4
I+_pu []	0.996102	0.010753	-0.985349
I-_pu []	-6.481e-3	9.471e-4	7.428e-3
P+_pu []	0.025517	0.918408	0.892891

Test 5.2.3
A.2.3(b): Depth of fault phase:0.50 p.u, two-phase SC-Gnd, △/Yn11, 20% load

	A	B	Delta
Time [s]	0:21.56847	0:23.47938	1.91090
AI 4/U1 [V]	28.26452	-191.9804	-220.2449
AI 4/U2 [V]	-577.1258	567.8466	1144.972
AI 4/U3 [V]	547.7677	-377.0118	-924.7795
U+_pu []	0.687721	0.692801	5.080e-3
U-_pu []	0.157291	0.159923	2.632e-3
I+_pu []	0.678159	0.633989	-0.044170
I-_pu []	-0.349186	-0.314617	0.034570
P+_pu []	-6.540e-3	0.033510	0.040050

Test 5.2.3
A.2.3(b): Depth of fault phase:0.50 p.u, two-phase SC-Gnd, △/Yn11, 20% load, restoring time

	A	B	Delta
Time [s]	0:23.47036	0:23.60557	0.13521
AI 4/U1 [V]	377.8072	-544.1192	-921.9263
AI 4/U2 [V]	-509.2557	-396.3936	112.8621
AI 4/U3 [V]	132.2894	940.8775	808.5881
U+_pu []	0.692686	1.007806	0.315119
U-_pu []	0.159492	1.660e-3	-0.157832
I+_pu []	0.633841	-5.350e-3	-0.639191
I-_pu []	-0.315041	0.017349	0.332391
P+_pu []	0.032629	0.225350	0.192722

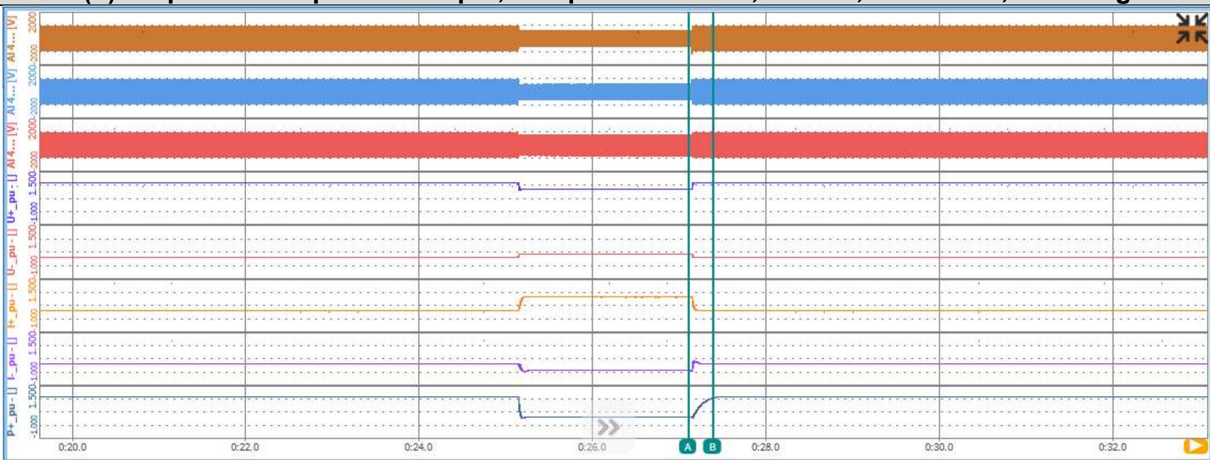
Test 5.2.4

A.2.3(b): Depth of fault phase:0.50 p.u, two-phase SC-Gnd, △/Yn11, 100% load

	A	B	Delta
Time [s]	0:25.24229	0:27.10666	1.86437
AI 4/U1 [V]	484.1388	443.5218	-40.61699
AI 4/U2 [V]	-445.0920	341.5175	786.6095
AI 4/U3 [V]	-39.83355	-786.4712	-746.6376
U+_pu []	0.689543	0.692990	3.447e-3
U-_pu []	0.157623	0.159928	2.305e-3
I+_pu []	0.663048	0.641682	-0.021366
I-_pu []	-0.341989	-0.315400	0.026589
P+_pu []	9.218e-3	0.032239	0.023021

Test 5.2.4

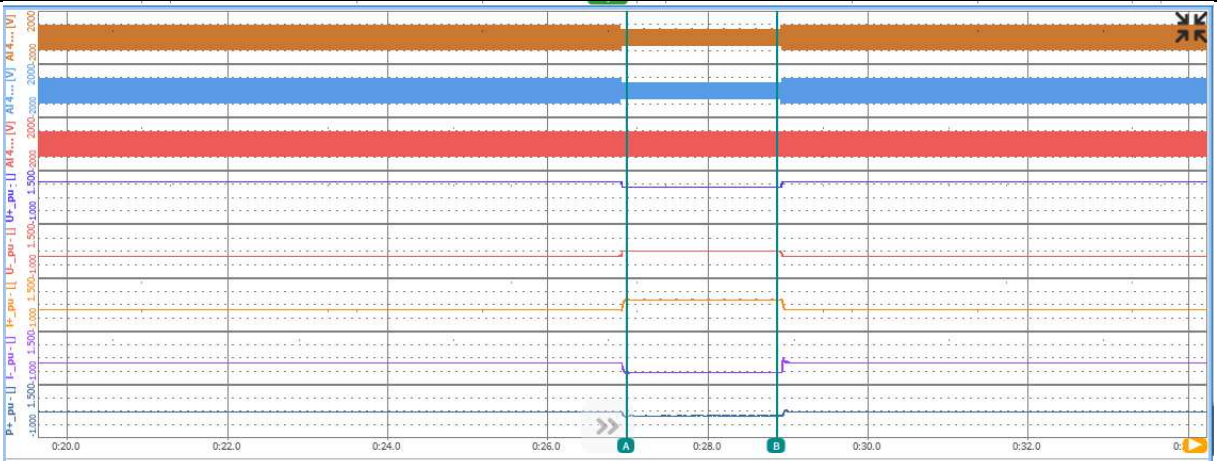
A.2.3(b): Depth of fault phase:0.50 p.u, two-phase SC-Gnd, △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:27.10666	0:27.38877	0.28211
AI 4/U1 [V]	443.5218	-45.16387	-488.6856
AI 4/U2 [V]	341.5175	841.1284	499.6109
AI 4/U3 [V]	-786.4712	-796.1810	-9.709836
U+_pu []	0.692990	1.010417	0.317427
U-_pu []	0.159928	3.691e-3	-0.156237
I+_pu []	0.641682	0.011634	-0.630048
I-_pu []	-0.315400	-1.505e-3	0.313895
P+_pu []	0.032239	0.915503	0.883264

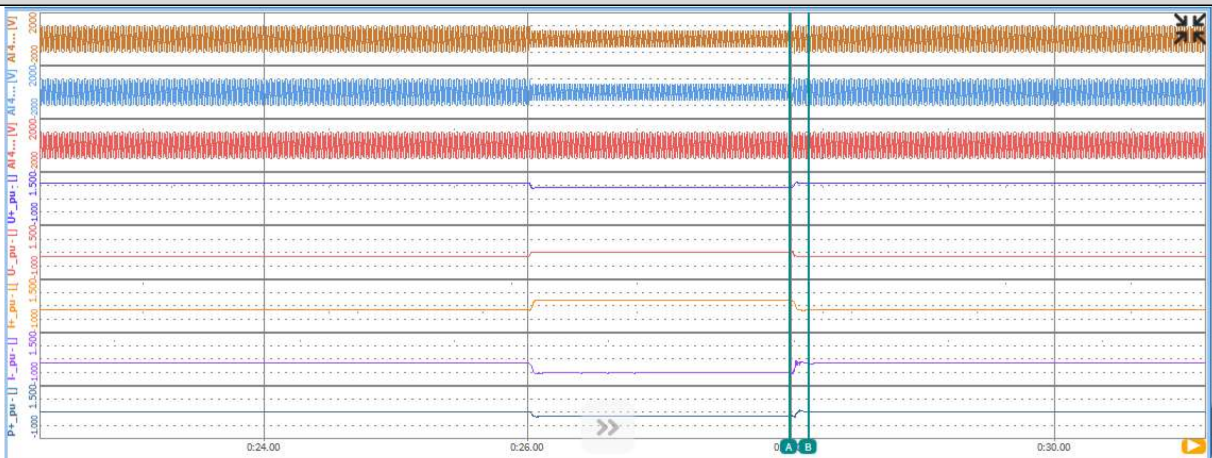
Test 5.2.5

A.2.4(b): Depth of fault phase:0.50 p.u, two-phase SC(no ground), △/Yn11, 20% load



	A	B	Delta
Time [s]	0:26.98610	0:28.85972	1.87362
AI 4/U1 [V]	-12.80904	604.9686	617.7776
AI 4/U2 [V]	617.1525	-177.2792	-794.4317
AI 4/U3 [V]	-604.1170	-428.0148	176.1022
U+_pu []	0.764913	0.767977	3.064e-3
U-_pu []	0.230878	0.232468	1.590e-3
I+_pu []	0.495127	0.471796	-0.023330
I-_pu []	-0.504341	-0.456001	0.048340
P+_pu []	-7.922e-3	0.041372	0.049294

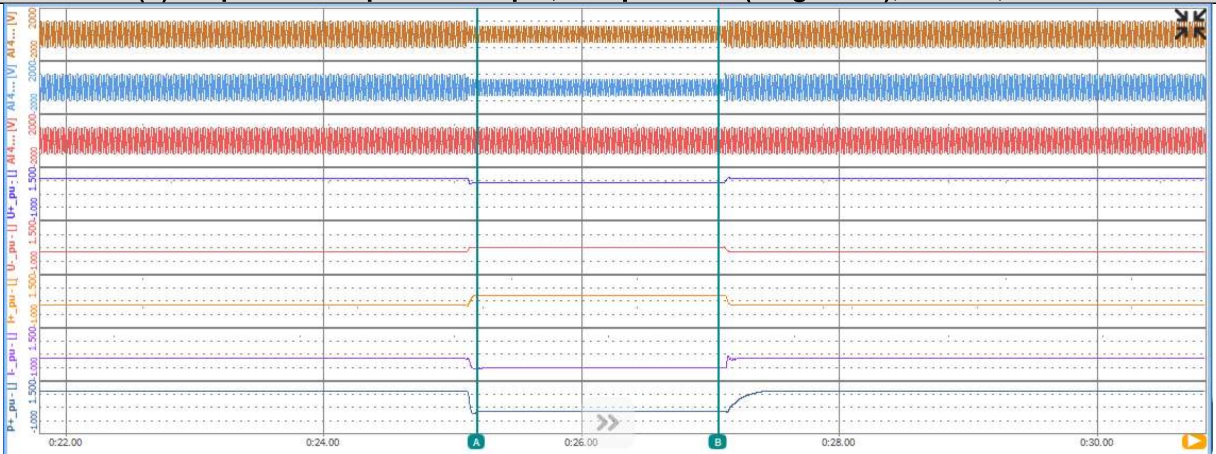
A.2.4(b): Depth of fault phase:0.50 p.u, two-phase SC(no ground), △/Yn11, 20% load, restoring time



	A	B	Delta
Time [s]	0:27.98649	0:28.13160	0.14511
AI 4/U1 [V]	-521.3659	799.1672	1320.533
AI 4/U2 [V]	-411.2396	-819.2175	-407.9778
AI 4/U3 [V]	933.1837	20.00499	-913.1787
U+_pu []	0.767825	1.005637	0.237811
U-_pu []	0.232643	1.523e-3	-0.231120
I+_pu []	0.468988	-2.442e-3	-0.471430
I-_pu []	-0.456892	6.662e-3	0.463554
P+_pu []	0.041622	0.214930	0.173308

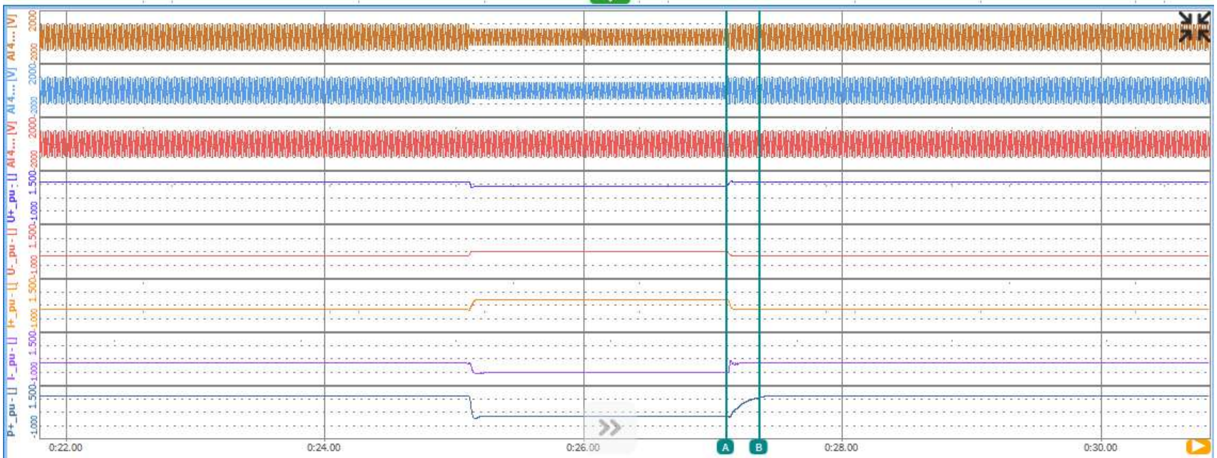
Test 5.2.6

A.2.4(b): Depth of fault phase:0.50 p.u, two-phase SC(no ground), △/Yn11, 100% load



	A	B	Delta
Time [s]	0:25.18896	0:27.05972	1.87075
AI 4/U1 [V]	-486.7816	335.9628	822.7444
AI 4/U2 [V]	-450.1963	566.5684	1016.765
AI 4/U3 [V]	936.9243	-902.7529	-1839.677
U+_pu []	0.764332	0.768091	3.759e-3
U-_pu []	0.230594	0.233142	2.549e-3
I+_pu []	0.496951	0.482086	-0.014865
I-_pu []	-0.507915	-0.453266	0.054649
P+_pu []	-0.039018	0.031949	0.070967

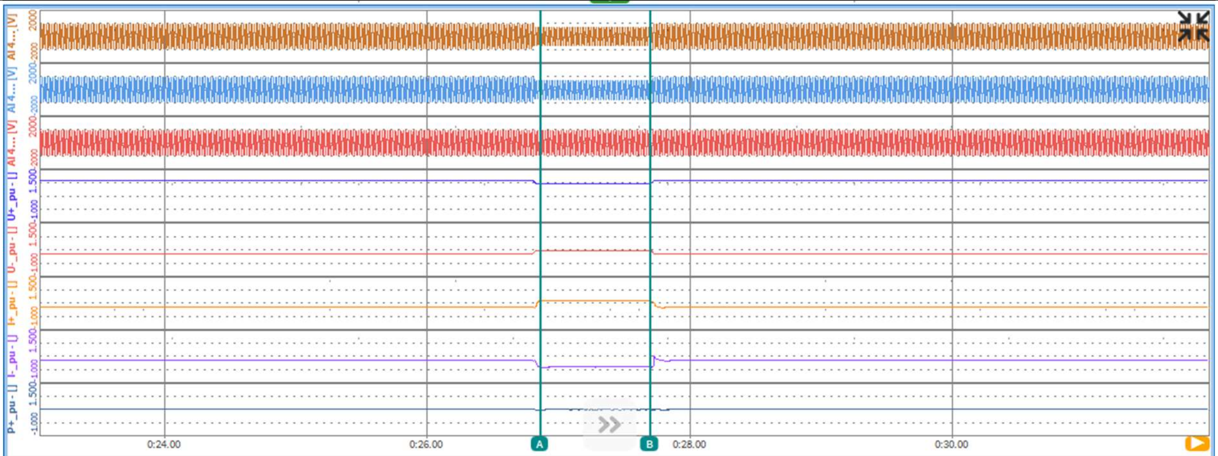
A.2.4(b): Depth of fault phase:0.50 p.u, two-phase SC(no ground), △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:27.10092	0:27.35640	0.25548
AI 4/U1 [V]	128.3543	914.0950	785.7407
AI 4/U2 [V]	612.9980	-242.2033	-855.2013
AI 4/U3 [V]	-740.8784	-673.0934	67.78503
U+_pu []	0.768891	1.011485	0.242594
U-_pu []	0.234705	3.821e-3	-0.230884
I+_pu []	0.487369	0.011875	-0.475493
I-_pu []	-0.453290	-1.178e-3	0.452112
P+_pu []	0.036266	0.909274	0.873008

Test 5.2.7

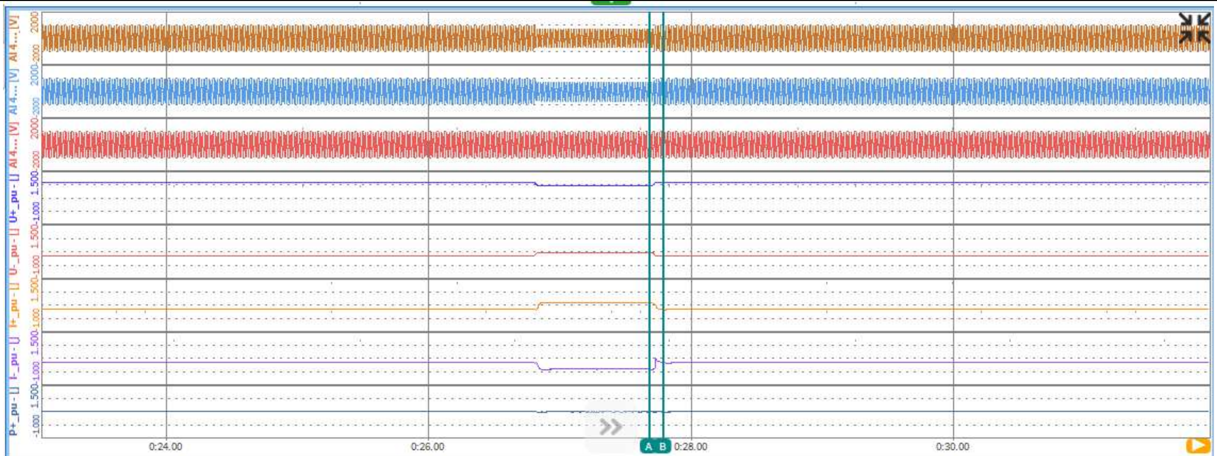
A.2.5(b): Depth of fault phase:0.50 p.u, single-phase SC-Gnd, △/Yn11, 20% load



	A	B	Delta
Time [s]	0:26.86359	0:28.69852	1.83494
AI 4/U1 [V]	-396.6217	-609.1619	-212.5402
AI 4/U2 [V]	-529.1570	507.6440	1036.801
AI 4/U3 [V]	925.3555	101.4695	-823.8860
U+_pu []	0.839938	0.845731	5.793e-3
U-_pu []	0.159365	0.158494	-8.717e-4
I+_pu []	0.308380	0.314052	5.671e-3
I-_pu []	-0.294774	-0.308433	-0.013659
P+_pu []	0.187444	0.201450	0.014006

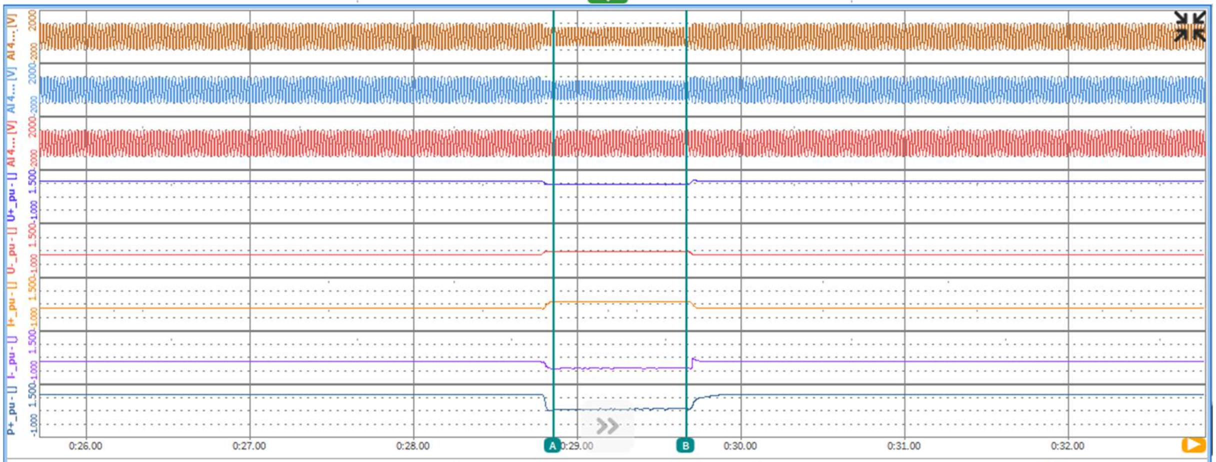
Test 5.2.7

A.2.5(b): Depth of fault phase:0.50 p.u, single-phase SC-Gnd, △/Yn11, 20% load, restoring time



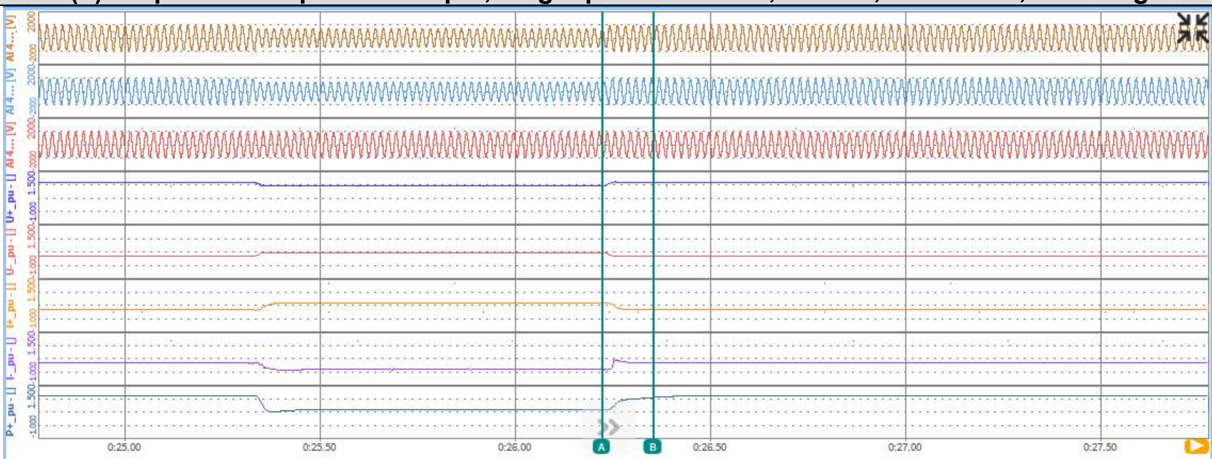
	A	B	Delta
Time [s]	0:27.68231	0:27.78769	0.10538
AI 4/U1 [V]	-600.4925	716.1353	1316.628
AI 4/U2 [V]	-301.4431	-882.1240	-580.6809
AI 4/U3 [V]	902.9949	167.0079	-735.9870
U+_pu []	0.845841	1.005996	0.160155
U-_pu []	0.156745	3.113e-3	-0.153632
I+_pu []	0.324753	-1.075e-3	-0.325828
I-_pu []	-0.302019	0.033590	0.335609
P+_pu []	0.199781	0.200926	1.145e-3

Test 5.2.8
A.2.5(b): Depth of fault phase:0.50 p.u, single-phase SC-Gnd, △/Yn11, 100% load



	A	B	Delta
Time [s]	0:28.85418	0:30.66434	1.81016
AI 4/U1 [V]	-185.1301	232.9142	418.0444
AI 4/U2 [V]	715.2482	-715.5109	-1430.759
AI 4/U3 [V]	-530.3955	481.7596	1012.155
U+_pu []	0.841565	0.846344	4.779e-3
U-_pu []	0.158075	0.157620	-4.554e-4
I+_pu []	0.323893	0.328554	4.661e-3
I-_pu []	-0.324227	-0.302196	0.022031
P+_pu []	0.221206	0.302749	0.081543

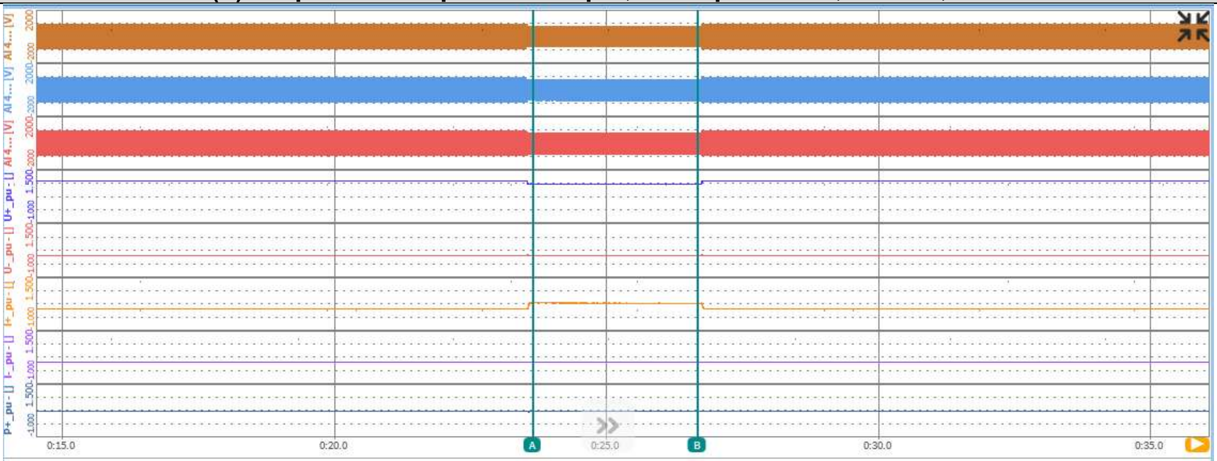
Test 5.2.8
A.2.5(b): Depth of fault phase:0.50 p.u, single-phase SC-Gnd, △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:26.22320	0:26.35419	0.13099
AI 4/U1 [V]	716.6114	-749.5404	-1466.152
AI 4/U2 [V]	-11.71756	-118.7310	-107.0135
AI 4/U3 [V]	-703.4657	867.8365	1571.302
U+_pu []	0.846104	1.009260	0.163156
U-_pu []	0.154872	3.756e-3	-0.151116
I+_pu []	0.315338	9.271e-3	-0.306068
I-_pu []	-0.302182	9.975e-3	0.312157
P+_pu []	0.304161	0.905193	0.601033

Test 5.3.1

A.2.2(b): Depth of fault phase:0.85 p.u, three-phase SC, △/Yn11, 20% load



	A	B	Delta
Time [s]	0:23.65496	0:26.67788	3.02292
AI 4/U1 [V]	414.1217	800.5534	386.4317
AI 4/U2 [V]	-802.3689	-485.3432	317.0257
AI 4/U3 [V]	388.8674	-316.0811	-704.9485
U+_pu []	0.859076	0.862882	3.806e-3
U-_pu []	1.660e-3	1.868e-3	2.081e-4
I+_pu []	0.290487	0.277866	-0.012620
I-_pu []	2.004e-3	1.237e-3	-7.667e-4
P+_pu []	0.208961	0.203199	-5.762e-3

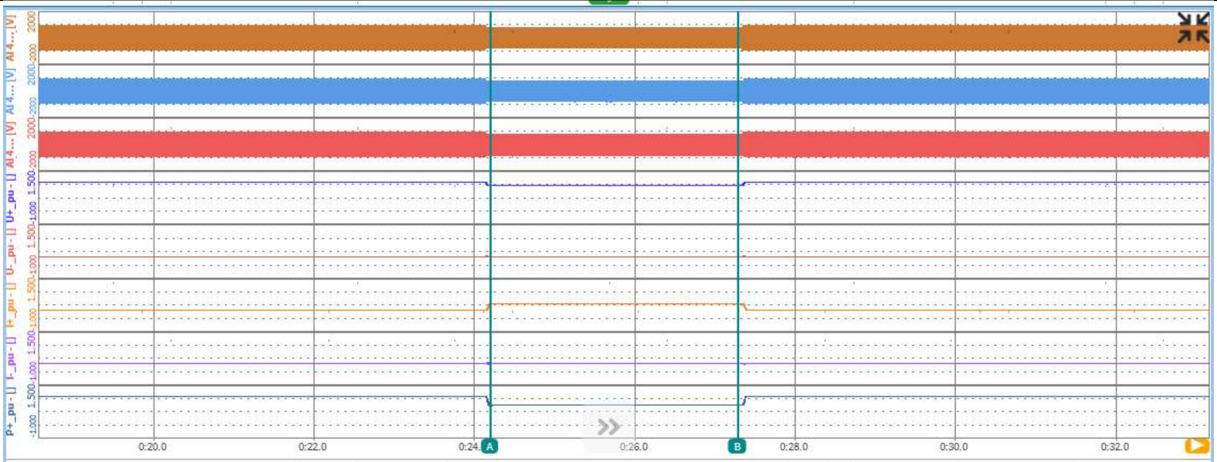
Test 5.3.1

A.2.2(b): Depth of fault phase:0.85 p.u, three-phase SC, △/Yn11, 20% load, restoring time

	A	B	Delta
Time [s]	0:26.69751	0:26.91304	0.21553
AI 4/U1 [V]	786.3176	-61.51152	-847.8292
AI 4/U2 [V]	-544.5357	-776.5284	-231.9927
AI 4/U3 [V]	-241.0441	839.1932	1080.237
U+_pu []	0.862747	1.006082	0.143334
U-_pu []	1.834e-3	8.818e-4	-9.521e-4
I+_pu []	0.279413	5.262e-4	-0.278887
I-_pu []	-7.260e-4	8.920e-4	1.618e-3
P+_pu []	0.203386	0.203135	-2.512e-4

Test 5.3.2

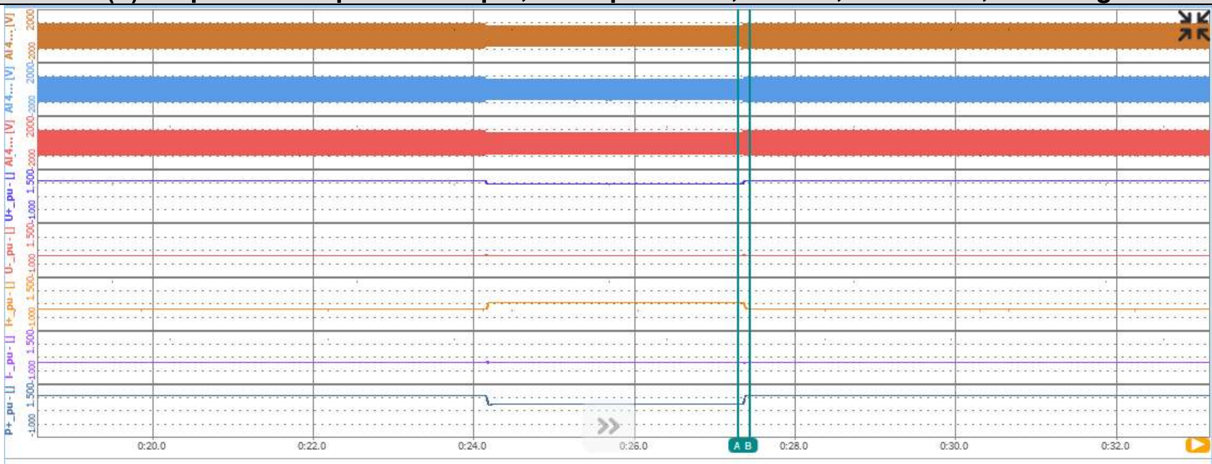
A.2.2(b): Depth of fault phase:0.85 p.u, three-phase SC, △/Yn11, 100% load



	A	B	Delta
Time [s]	0:24.20391	0:27.28748	3.08357
AI 4/U1 [V]	-775.1148	-485.2753	289.8395
AI 4/U2 [V]	540.9994	-311.6651	-852.6645
AI 4/U3 [V]	234.4315	796.0594	561.6279
U+_pu []	0.854396	0.857078	2.683e-3
U-_pu []	3.421e-3	4.085e-3	6.644e-4
I+_pu []	0.317027	0.309029	-7.998e-3
I-_pu []	-5.158e-3	-5.941e-4	4.564e-3
P+_pu []	0.533584	0.592732	0.059148

Test 5.3.2

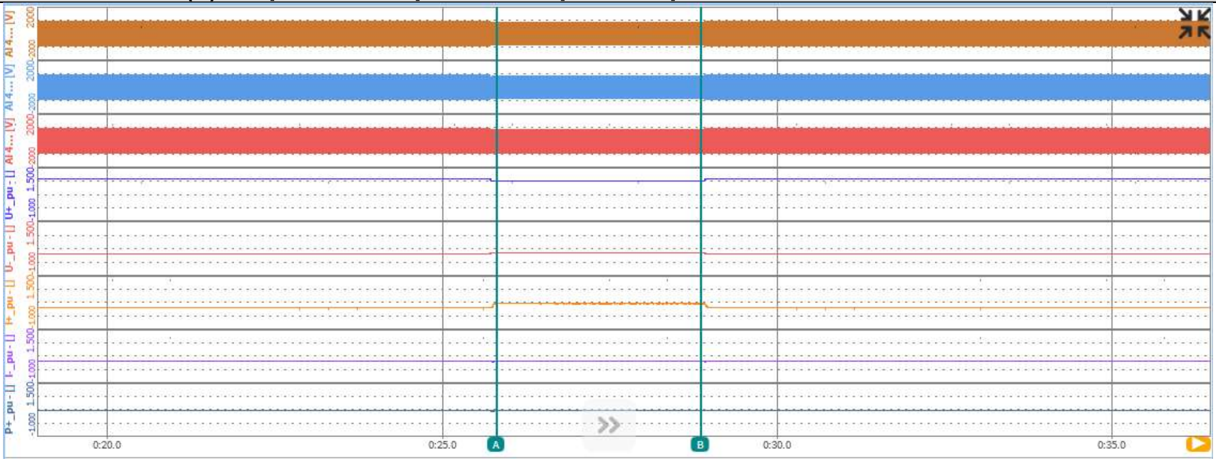
A.2.2(b): Depth of fault phase:0.85 p.u, three-phase SC, △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:27.28748	0:27.43342	0.14594
AI 4/U1 [V]	-485.2753	887.4317	1372.707
AI 4/U2 [V]	-311.6651	-718.8340	-407.1689
AI 4/U3 [V]	796.0594	-167.8114	-963.8708
U+_pu []	0.857078	1.010282	0.153204
U-_pu []	4.085e-3	4.650e-3	5.648e-4
I+_pu []	0.309029	4.985e-3	-0.304044
I-_pu []	-5.941e-4	1.969e-4	7.909e-4
P+_pu []	0.592732	0.980302	0.387570

Test 5.3.3

A.2.3(b): Depth of fault phase:0.85 p.u, two-phase SC-GND, △/Yn11, 20% load



	A	B	Delta
Time [s]	0:25.81255	0:28.85782	3.04527
AI 4/U1 [V]	831.9209	-40.11107	-872.0320
AI 4/U2 [V]	-394.8181	763.5262	1158.344
AI 4/U3 [V]	-437.7713	-724.4065	-286.6352
U+_pu []	0.909145	0.911764	2.619e-3
U-_pu []	0.050082	0.049730	-3.515e-4
I+_pu []	0.190534	0.182423	-8.111e-3
I-_pu []	-0.011150	-2.663e-3	8.488e-3
P+_pu []	0.214443	0.204063	-0.010380

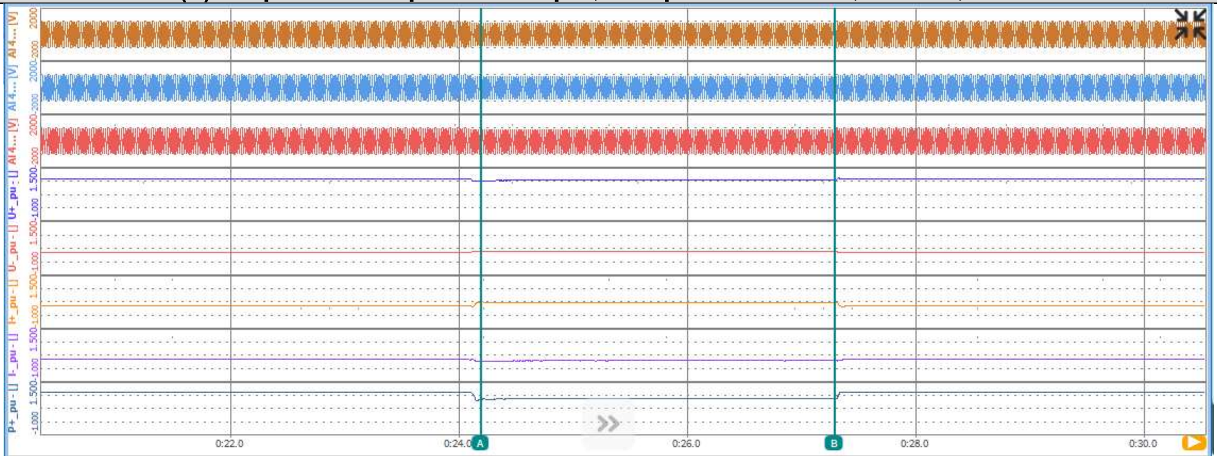
Test 5.3.3

A.2.3(b): Depth of fault phase:0.85 p.u, two-phase SC-GND, △/Yn11, 20% load, restoring time

	A	B	Delta
Time [s]	0:28.87376	0:29.04883	0.17506
AI 4/U1 [V]	778.6627	389.4930	-389.1697
AI 4/U2 [V]	-77.77191	-934.5053	-856.7334
AI 4/U3 [V]	-700.8043	545.8699	1246.674
U+_pu []	0.911845	1.005168	0.093322
U-_pu []	0.049747	3.952e-4	-0.049351
I+_pu []	0.182074	-1.518e-3	-0.183592
I-_pu []	-5.170e-3	-2.663e-4	4.904e-3
P+_pu []	0.202523	0.201161	-1.361e-3

Test 5.3.4

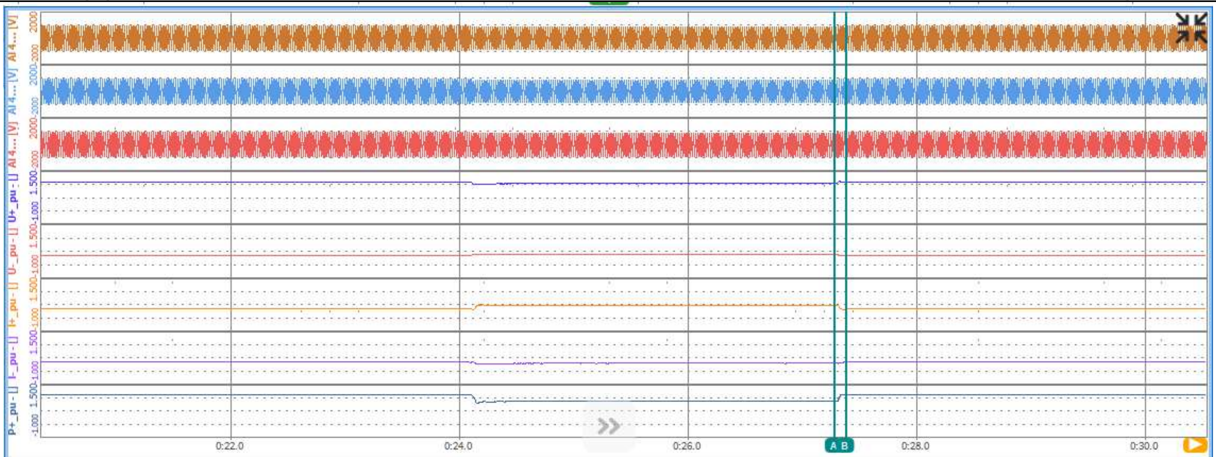
A.2.3(b): Depth of fault phase:0.85 p.u, two-phase SC-GND, △/Yn11, 100% load



	A	B	Delta
Time [s]	0:24.19133	0:27.28526	3.09393
AI 4/U1 [V]	-337.0435	-601.4336	-264.3900
AI 4/U2 [V]	-547.9613	772.6026	1320.564
AI 4/U3 [V]	885.0625	-171.3679	-1056.430
U+_pu []	0.912046	0.915283	3.236e-3
U-_pu []	0.050523	0.050199	-3.243e-4
I+_pu []	0.198281	0.190612	-7.669e-3
I-_pu []	-0.066944	-0.049312	0.017631
P+_pu []	0.629616	0.673719	0.044103

Test 5.3.4

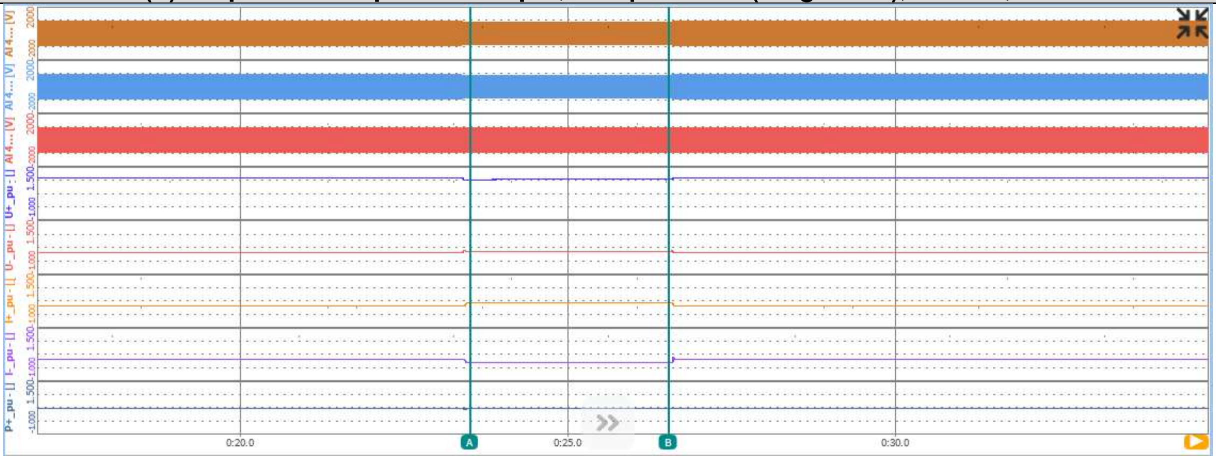
A.2.3(b): Depth of fault phase:0.85 p.u, two-phase SC-GND, △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:27.27596	0:27.37802	0.10205
AI 4/U1 [V]	715.8542	926.3561	210.5019
AI 4/U2 [V]	-674.5558	-306.4006	368.1553
AI 4/U3 [V]	-39.77680	-620.1718	-580.3950
U+_pu []	0.915447	1.010811	0.095364
U-_pu []	0.050241	4.017e-3	-0.046224
I+_pu []	0.190263	-6.075e-3	-0.196338
I-_pu []	-0.049356	2.350e-4	0.049591
P+_pu []	0.670092	0.985698	0.315606

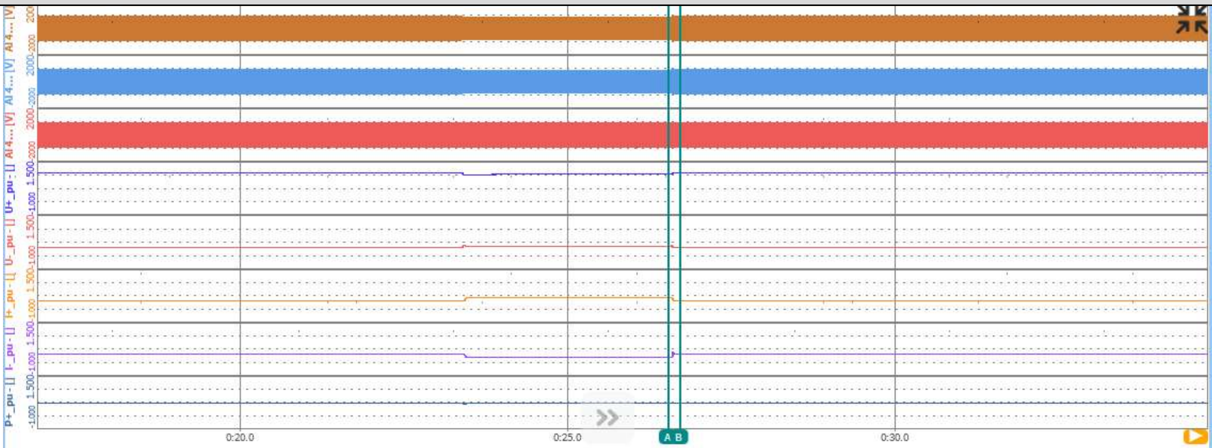
Test 5.3.5

A.2.4(b): Depth of fault phase:0.85 p.u, two-phase SC(no ground), △/Yn11, 20% load



	A	B	Delta
Time [s]	0:23.51581	0:26.54402	3.02822
AI 4/U1 [V]	704.3257	-843.1724	-1547.498
AI 4/U2 [V]	141.0167	326.5650	185.5483
AI 4/U3 [V]	-847.1346	516.3110	1363.446
U+_pu []	0.930479	0.933953	3.474e-3
U-_pu []	0.068022	0.066849	-1.173e-3
I+_pu []	0.141737	0.135582	-6.155e-3
I-_pu []	-0.140796	-0.128499	0.012297
P+_pu []	0.206078	0.202027	-4.051e-3

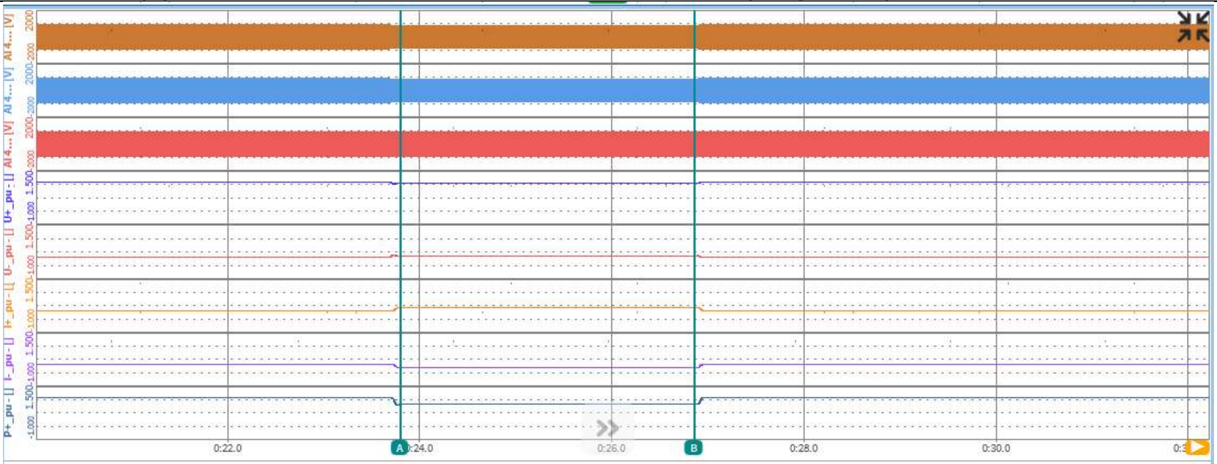
A.2.4(b): Depth of fault phase:0.85 p.u, two-phase SC(no ground), △/Yn11, 20% load, restoring time



	A	B	Delta
Time [s]	0:26.54402	0:26.72279	0.17876
AI 4/U1 [V]	-843.1724	-885.7952	-42.62281
AI 4/U2 [V]	326.5650	713.2948	386.7297
AI 4/U3 [V]	516.3110	171.2649	-345.0461
U+_pu []	0.933953	1.005370	0.071417
U-_pu []	0.066849	9.176e-4	-0.065931
I+_pu []	0.135582	-6.463e-3	-0.142046
I-_pu []	-0.128499	-1.634e-3	0.126865
P+_pu []	0.202027	0.200507	-1.520e-3

Test 5.3.6

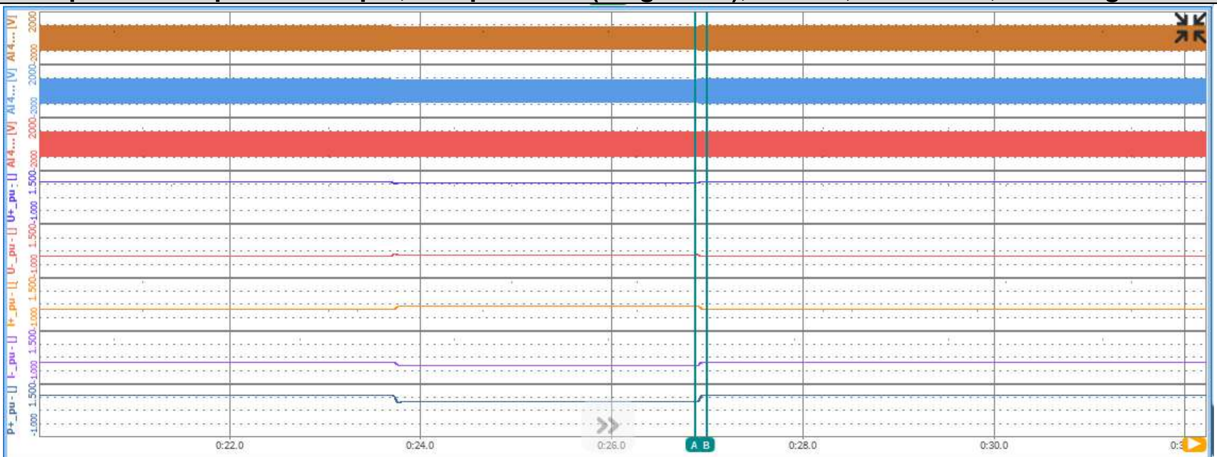
A.2.4(b): Depth of fault phase:0.85 p.u, two-phase SC(no ground), △/Yn11, 100% load



	A	B	Delta
Time [s]	0:23.80297	0:26.86001	3.05704
AI 4/U1 [V]	-52.89889	-686.3094	-633.4105
AI 4/U2 [V]	-751.8161	-196.8427	554.9734
AI 4/U3 [V]	805.7845	883.8676	78.08304
U+_pu []	0.937200	0.937713	5.125e-4
U-_pu []	0.069277	0.069086	-1.913e-4
I+_pu []	0.146694	0.145144	-1.550e-3
I-_pu []	-0.147172	-0.134088	0.013085
P+_pu []	0.665948	0.672987	7.039e-3

A.2.4(b):

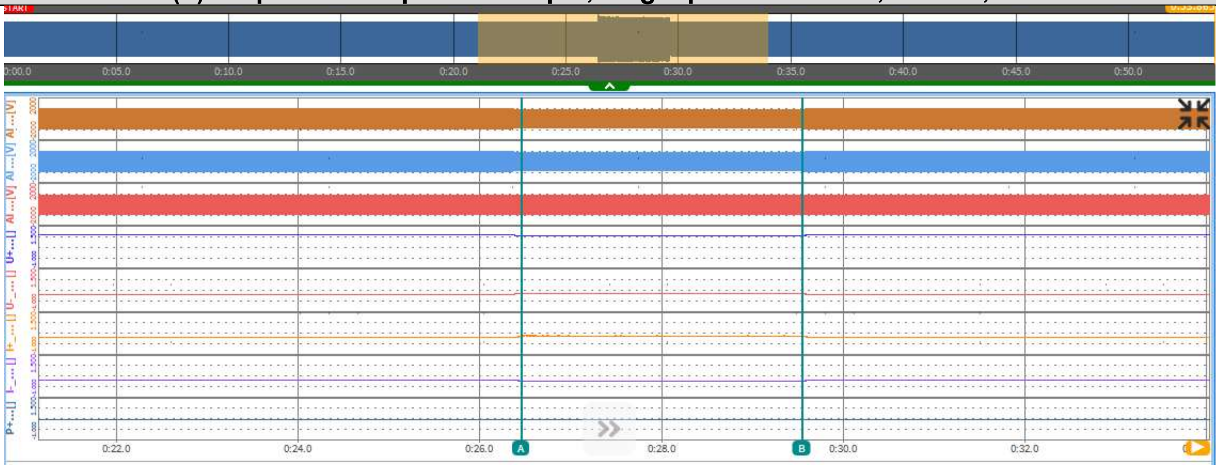
Depth of fault phase:0.85 p.u, two-phase SC(no ground), △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:26.87113	0:26.99341	0.12228
AI 4/U1 [V]	457.1686	-188.0624	-645.2310
AI 4/U2 [V]	485.3614	887.3010	401.9397
AI 4/U3 [V]	-943.0516	-700.0034	243.0482
U+_pu []	0.937583	1.008186	0.070603
U-_pu []	0.069195	4.937e-3	-0.064258
I+_pu []	0.143675	4.478e-3	-0.139197
I-_pu []	-0.134134	6.623e-3	0.140757
P+_pu []	0.672965	0.989633	0.316668

Test 5.3.7

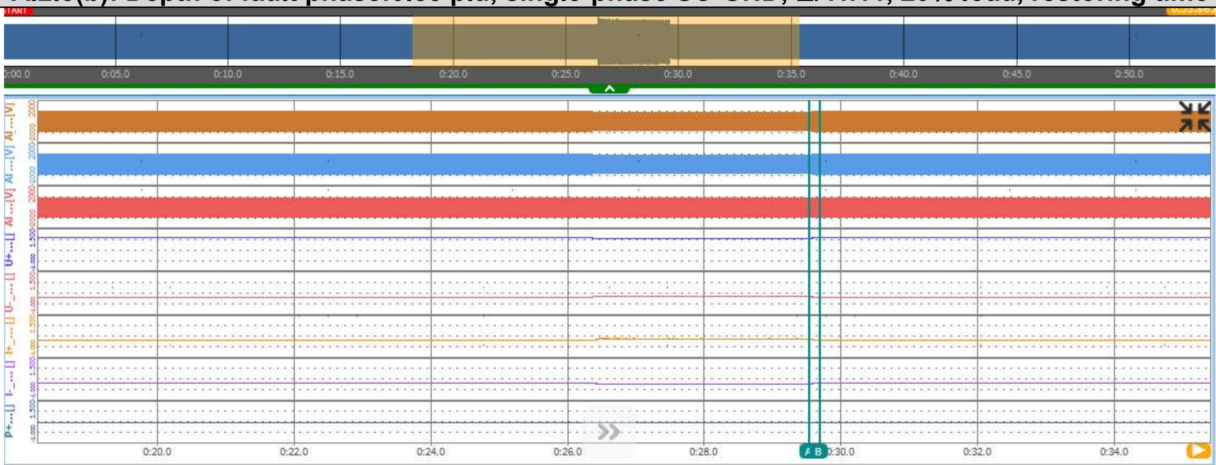
A.2.5(b): Depth of fault phase:0.85 p.u, single-phase SC-GND, △/Yn11, 20% load



	A	B	Delta
Time [s]	0:26.46085	0:29.54954	3.08869
AI 4/U1 [V]	-228.9832	525.0147	753.9978
AI 4/U2 [V]	-658.9311	413.8677	1072.799
AI 4/U3 [V]	887.6091	-938.8102	-1826.419
U+_pu []	0.952822	0.955546	2.724e-3
U-_pu []	0.050506	0.050459	-4.682e-5
I+_pu []	0.091977	0.092183	2.066e-4
I-_pu []	-0.069181	-0.038752	0.030430
P+_pu []	0.203998	0.203276	-7.218e-4

Test 5.3.7

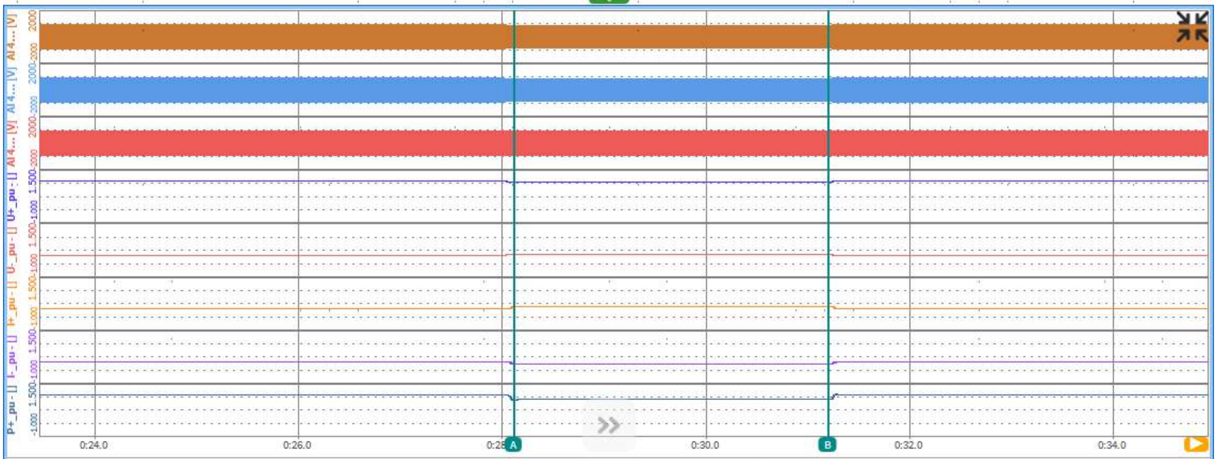
A.2.5(b): Depth of fault phase:0.85 p.u, single-phase SC-GND, △/Yn11, 20% load, restoring time



	A	B	Delta
Time [s]	0:29.53146	0:29.68815	0.15669
AI 4/U1 [V]	48.10643	801.4255	753.3191
AI 4/U2 [V]	761.3790	13.64470	-747.7344
AI 4/U3 [V]	-810.5851	-814.2088	-3.623724
U+_pu []	0.955477	1.004381	0.048905
U-_pu []	0.050419	3.098e-4	-0.050110
I+_pu []	0.092663	-6.117e-3	-0.098780
I-_pu []	-0.039557	-2.715e-3	0.036842
P+_pu []	0.201093	0.200797	-2.951e-4

Test 5.3.8

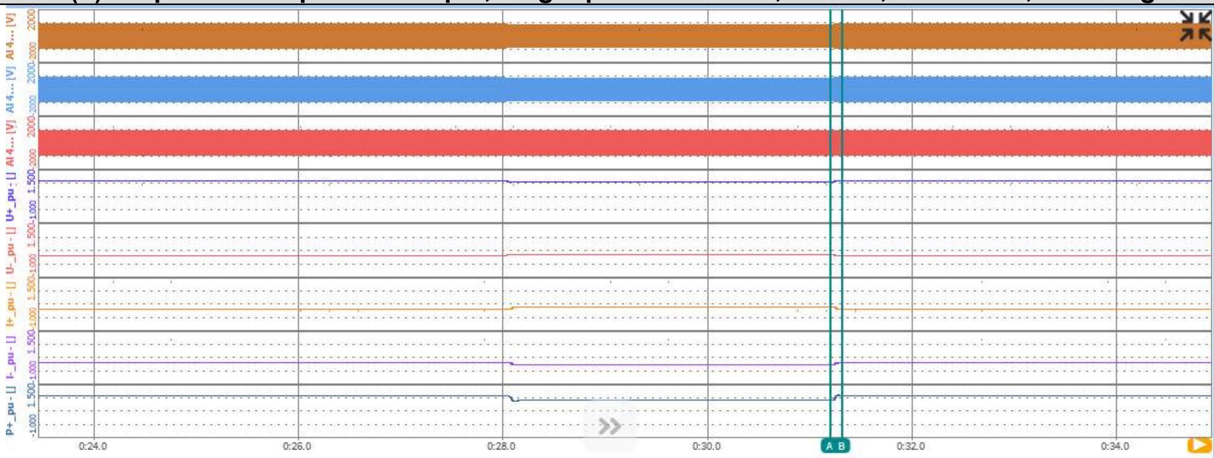
A.2.5(b): Depth of fault phase:0.85 p.u, single-phase SC-GND, △/Yn11, 100% load



	A	B	Delta
Time [s]	0:28.11709	0:31.19932	3.08223
AI 4/U1 [V]	-355.6986	-805.6300	-449.9314
AI 4/U2 [V]	870.5247	639.8073	-230.7174
AI 4/U3 [V]	-514.6041	164.3407	678.9449
U+_pu []	0.957193	0.959442	2.248e-3
U-_pu []	0.051822	0.051163	-6.583e-4
I+_pu []	0.098762	0.097386	-1.376e-3
I-_pu []	-0.108047	-0.093210	0.014837
P+_pu []	0.721620	0.768538	0.046918

Test 5.3.8

A.2.5(b): Depth of fault phase:0.85 p.u, single-phase SC-GND, △/Yn11, 100% load, restoring time



	A	B	Delta
Time [s]	0:31.19953	0:31.31425	0.11472
AI 4/U1 [V]	-821.8177	352.6838	1174.501
AI 4/U2 [V]	594.5304	581.8346	-12.69579
AI 4/U3 [V]	228.3185	-934.6436	-1162.962
U+_pu []	0.959499	1.009578	0.050080
U-_pu []	0.051095	4.463e-3	-0.046632
I+_pu []	0.097505	-2.229e-3	-0.099735
I-_pu []	-0.093060	2.310e-3	0.095370
P+_pu []	0.768650	1.000994	0.232345

Appendix: Pictures

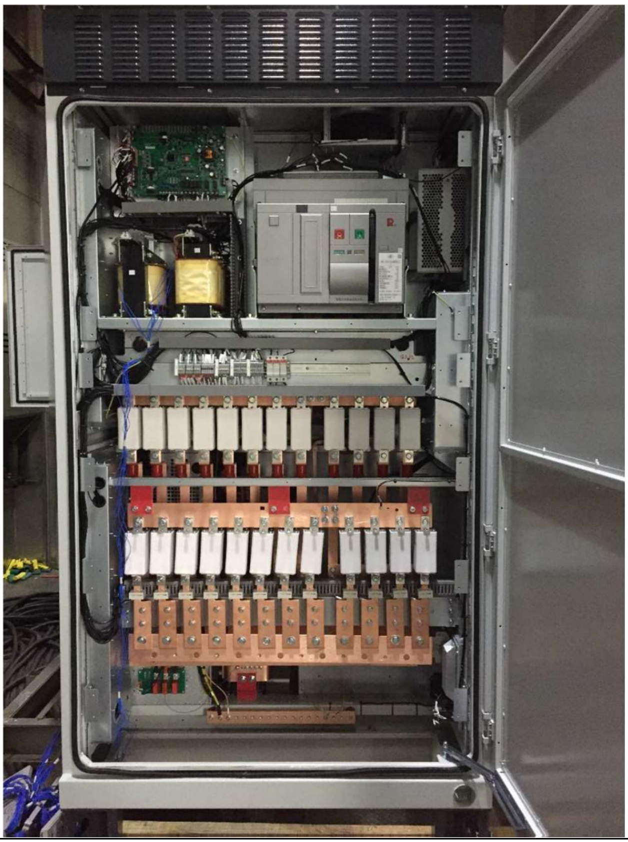
Overall view –front

Overall view –back

Overall view – right

Overall view – left


Inside view -1



Inside view -2

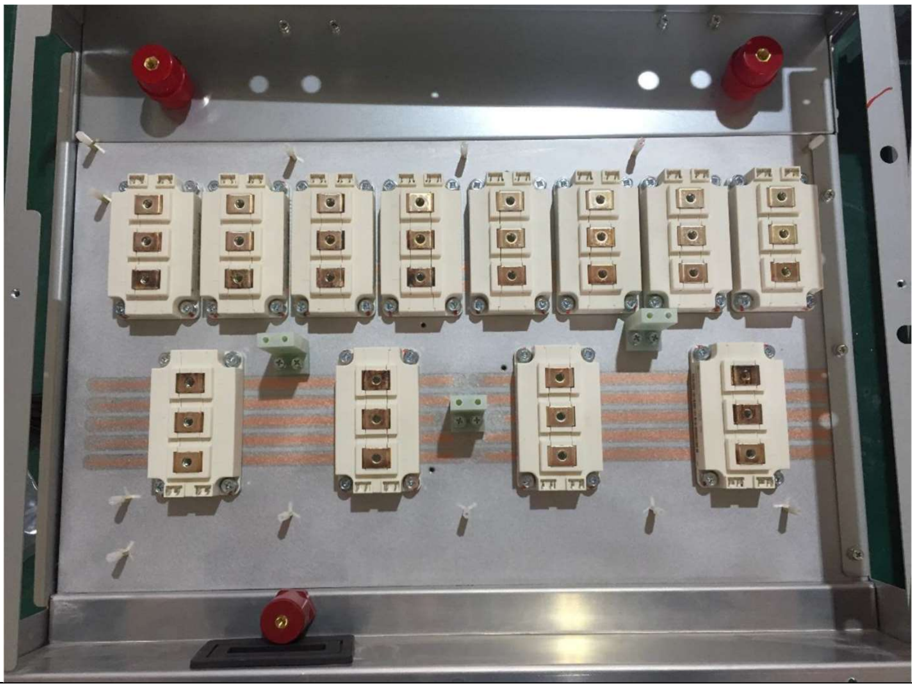
Inside view -3

Isolating switch I

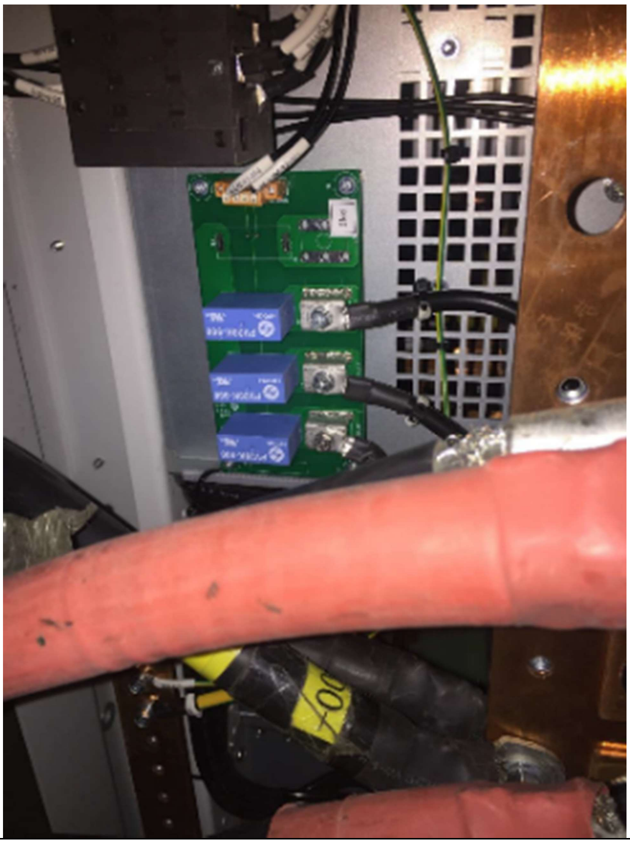

Isolating switch II

Isolating switch III

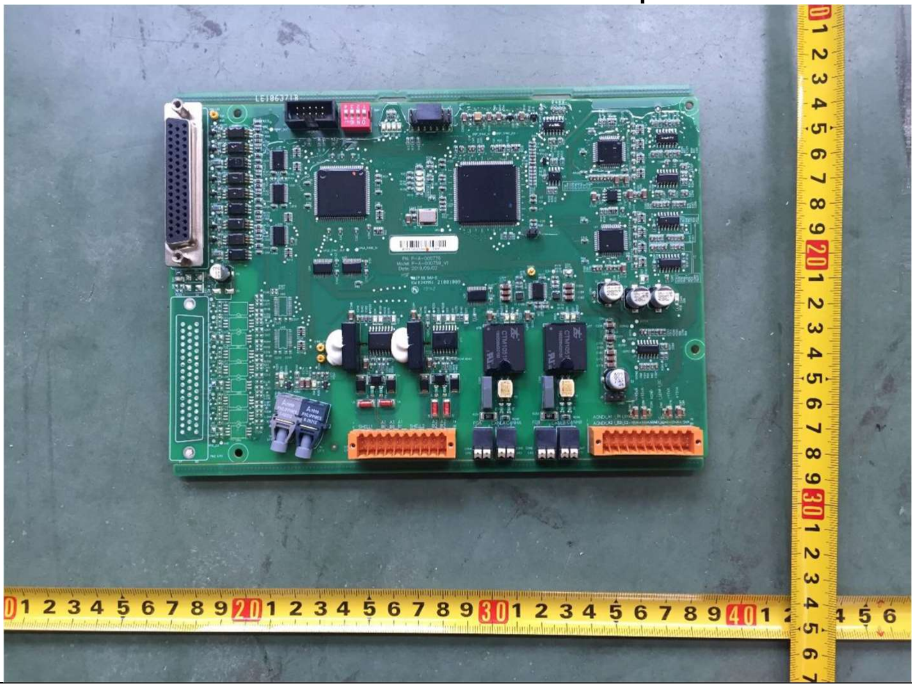

FUSE

IGBT


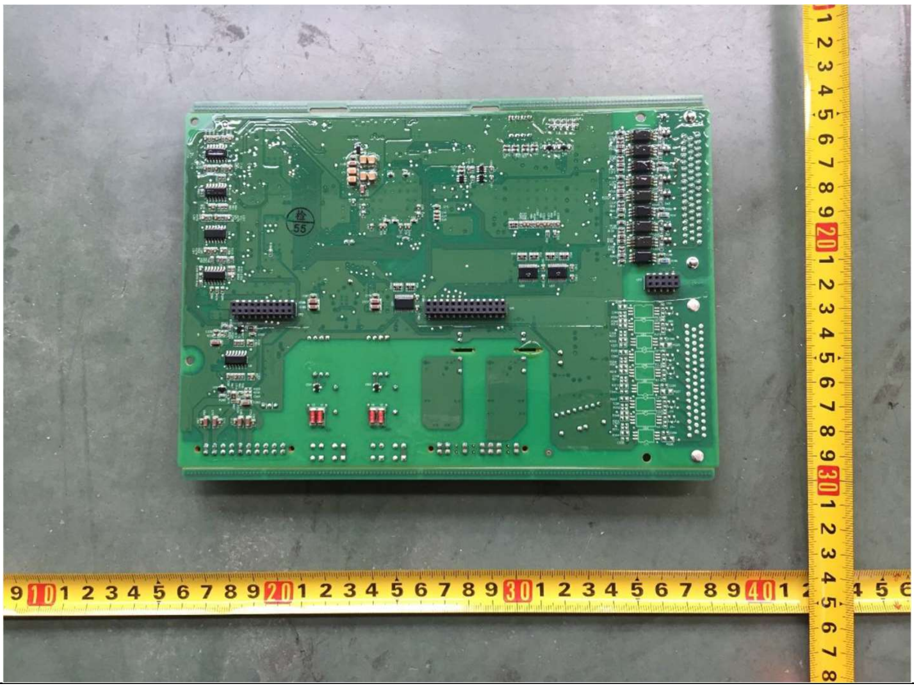
Inductor

Inside view - 4


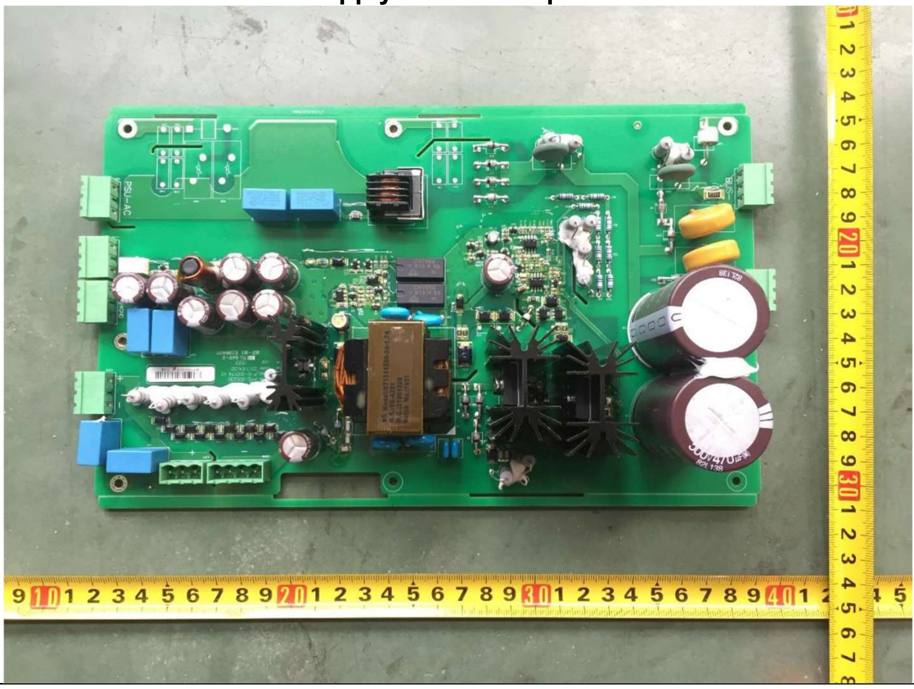
Control and communication board –component side



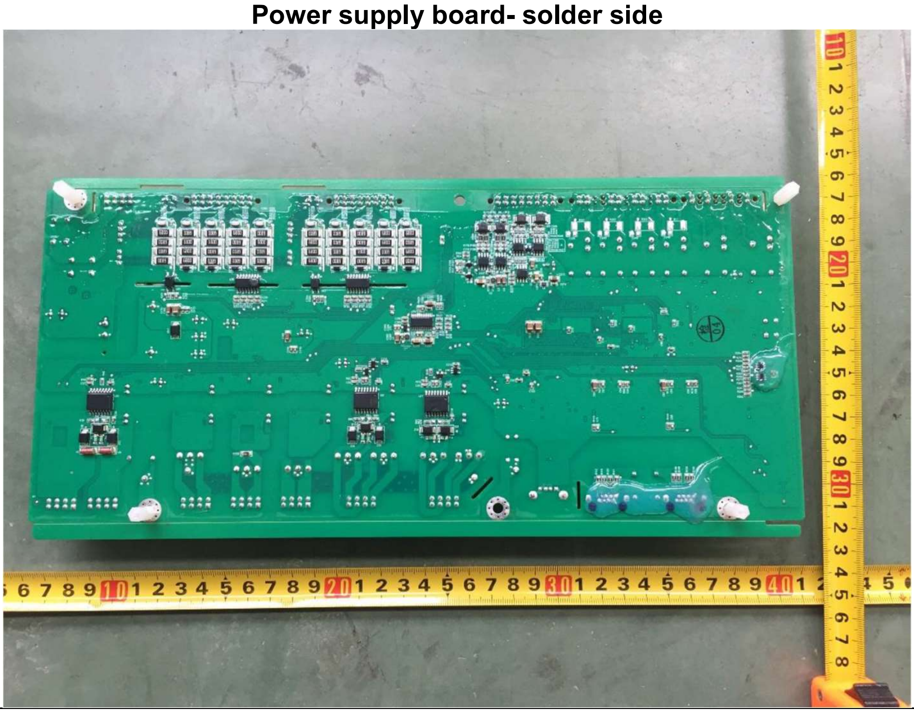
Control and communication board – solder Side



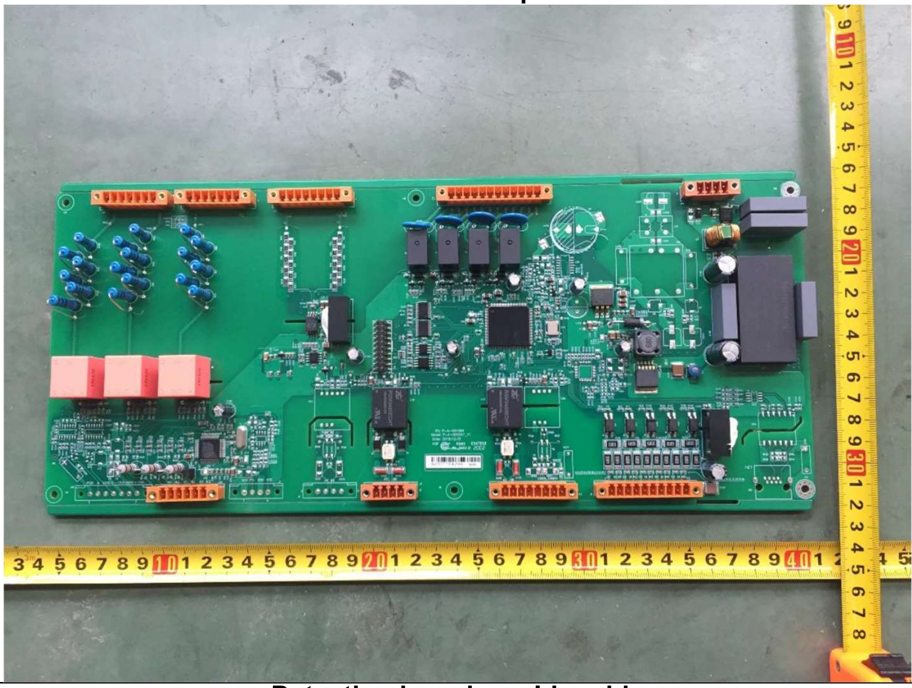
Power supply board- component side



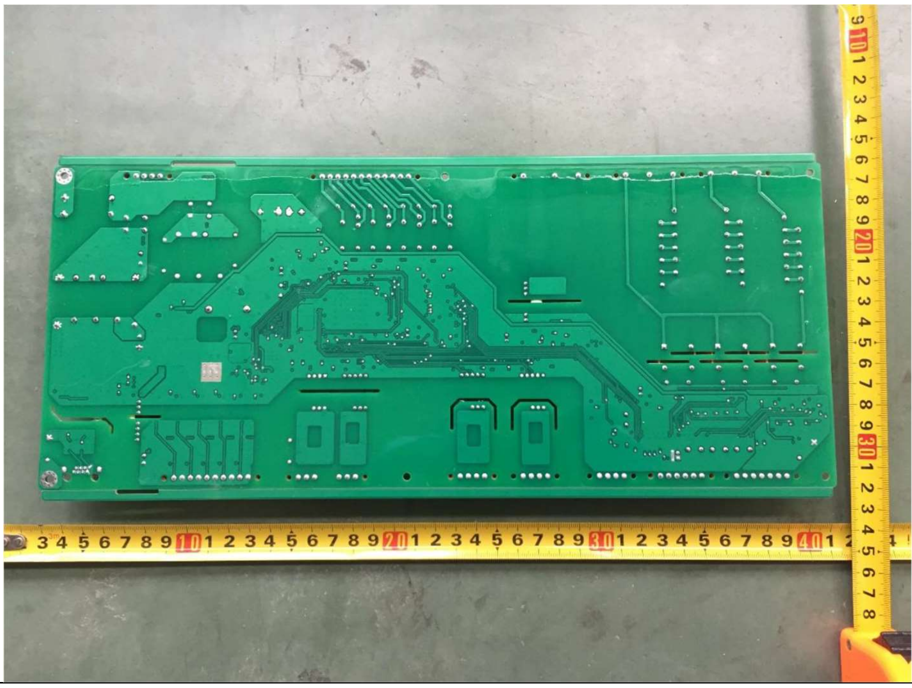
Power supply board- solder side

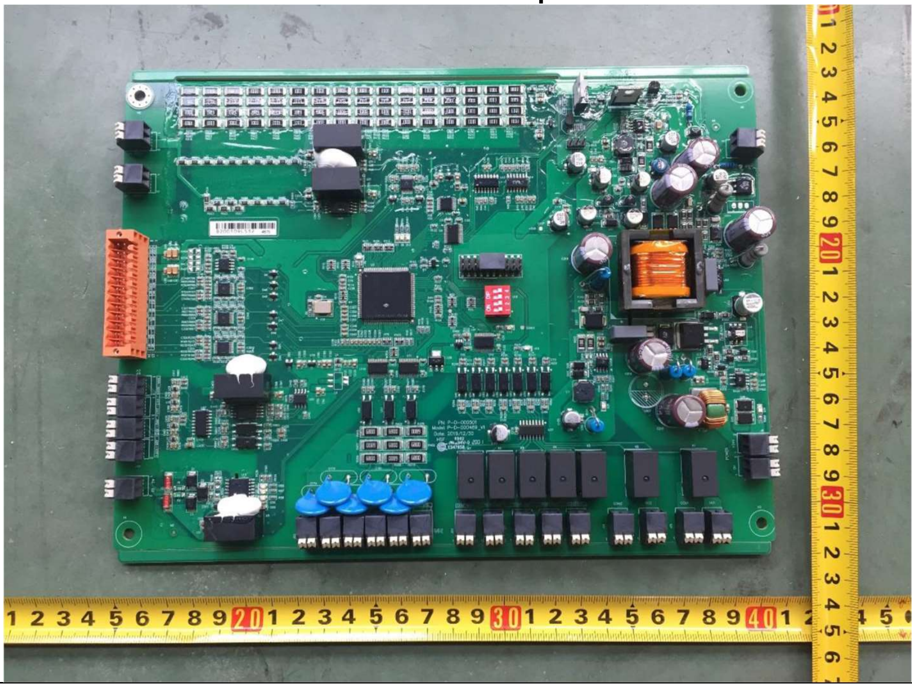
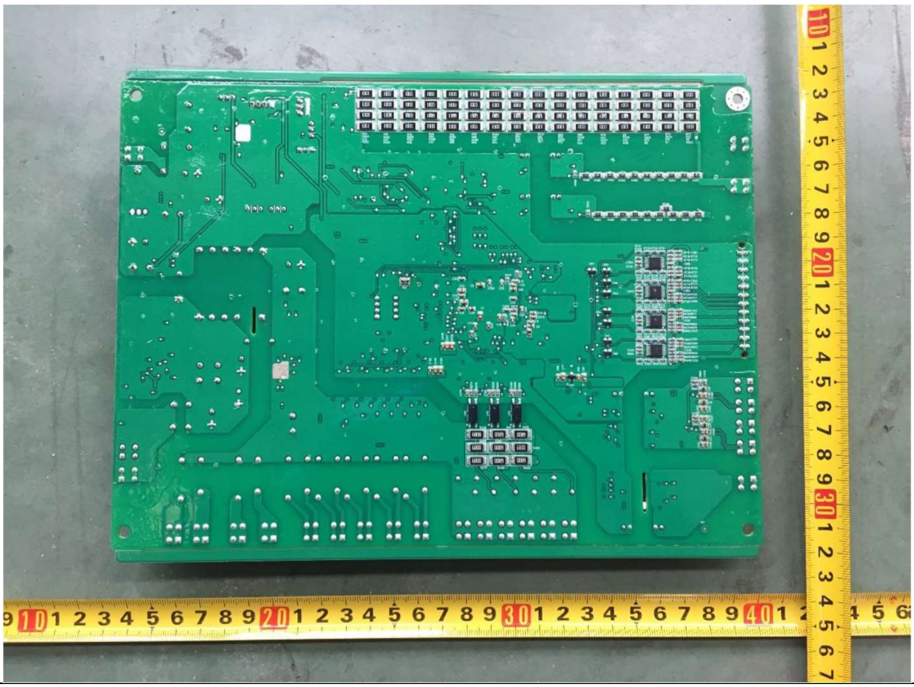


Detection board- component side

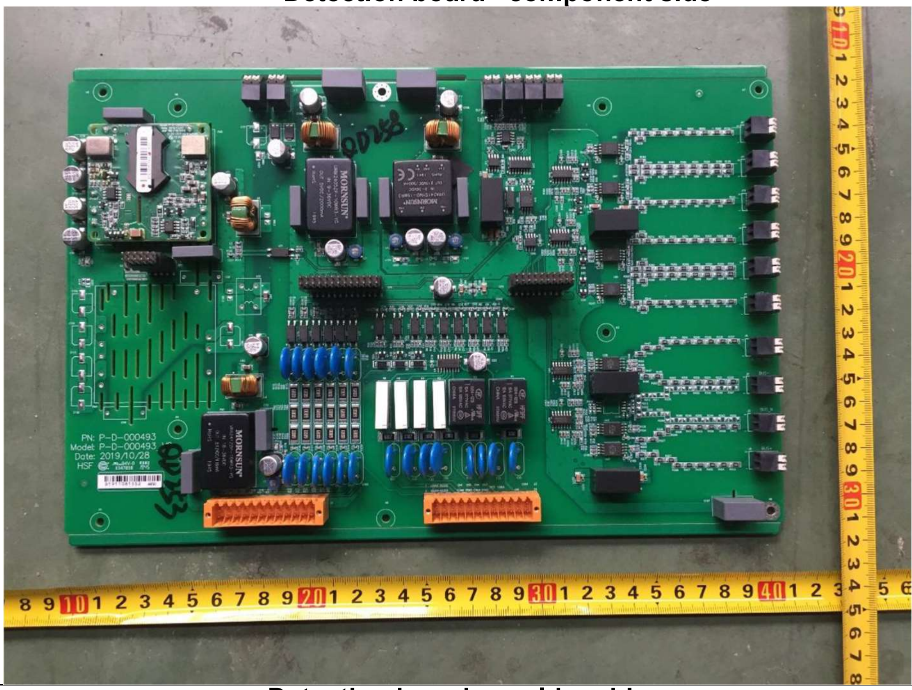


Detection board – solder side

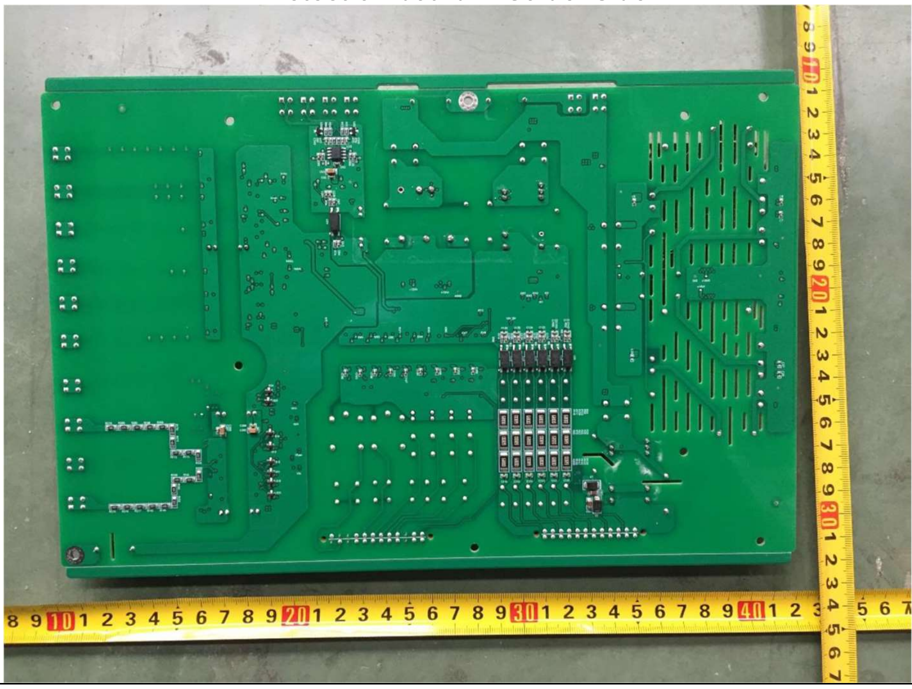


Control board - component side

Control board - solder side


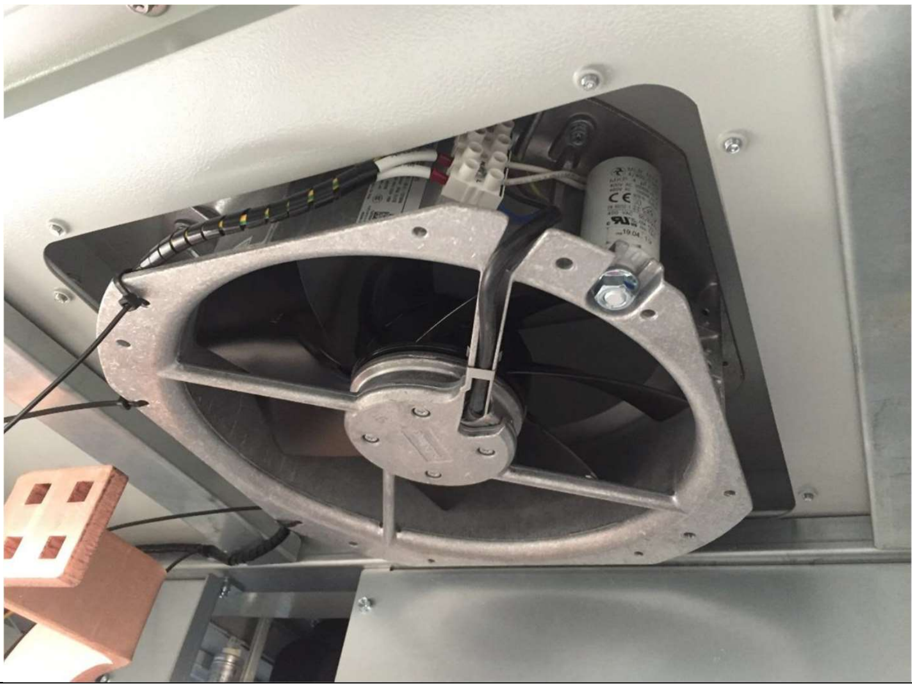
Detection board –component side



Detection board – solder side



Internal FAN



-------- End of test report--------

ATTESTATION OF CONFORMITY

Issued to: Sungrow Power Supply Co., Ltd.
No.1699 Xiyou Rd., New & High Technology Industrial Development Zone,
230088, Hefei, P. R. China

For the product: Grid-connected PV inverter

Trade name: 阳 光 电 源 SUNGROW

Type/Model: SG3125HV-30, SG3125HV-31, SG3125HV-32

Ratings: See Annex

Manufactured by: Sungrow Power Supply Co., Ltd.
No.1699 Xiyou Rd., New & High Technology Industrial Development Zone,
230088, Hefei, P. R. China

Requirements: IEC TS 62910:2020

This Attestation is granted on account of an examination by DEKRA, the results of which are laid down in a confidential file no. 6092407.51

The examination has been carried out on one single specimen or several specimens of the product, submitted by the manufacturer. The Attestation does not include an assessment of the manufacturer's production. Conformity of his production with the specimen tested by DEKRA is not the responsibility of DEKRA.

Arnhem, 23 December 2020 Number: 6092407.02AOC

DEKRA Testing and Certification (Shanghai) Ltd.

Kreny Lin
Certification Manager

DEKRA Testing and Certification (Shanghai) Ltd.
3F #250 Jiangchangsan Road Shibei Hi-Tech Park, 200436 Jing'an District, Shanghai, China
T +86 21 6056 7666 F +86 21 6056 7555 www.dekra-product-safety.com

Annex to 6092407.02AOC

Ratings of the test product:
Operating temperature range: - 35°C to + 60°C
Protective class: I
Ingress protection rating: IP65 (Optional IP55)
Power factor range (adjustable): 0.8 leading…0.8 lagging

SG3125HV-30:
PV input: Max. 1500 Vdc, MPPT voltage range: 875-1300 Vdc, max current: 3997 A, Isc PV: 10000 A
Output: 600V, 3~, 50/60 Hz, max 3308 A, rated 3125 kW, max 3437 kVA

SG3125HV-31:
PV input: Max. 1500 Vdc, MPPT voltage range: 915-1300 Vdc, max current: 3997 A, Isc PV: 10000 A
Output: 630V, 3~, 50/60 Hz, max 3308 A, rated 3125 kW, max 3610 kVA

SG3125HV-32:
PV input: Max. 1500 Vdc, MPPT voltage range: 960-1300 Vdc, max current: 3997 A, Isc PV: 10000 A
Output: 660V, 3~, 50/60 Hz, max 3308 A, rated 3125 kW, max 3781 kVA